Analysing the relationship between digitalisation and poverty dimension in Zimbabwe

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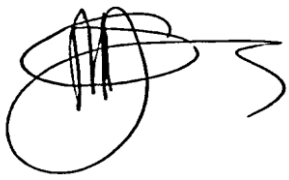
DEDICATION

I dedicate this piece of work to my lovely wife Lilian Mutseura, my late parents Nellie Kushata Nyamutswa and Kizito Hamunyari Nyamutswa, my brother Stanley Nyamutswa and sister Virginia Kudzai Nyamutswa.

DECLARATION

I declare that this thesis titled:

"Analysing the Relationship between Digitalisation and Poverty Dimension in Zimbabwe" is my own work, and that all the resources used have been fully acknowledged by means of in-text references and the reference list, and that I have not previously submitted the thesis for degree purposes at any other university or academic institution.



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Tapiwa Oliver Nyamutswa

ABSTRACT

This research delves into the dynamic interplay between digitalisation and various dimensions of poverty within the unique context of Zimbabwe's ten provinces, using secondary data obtained from Global Data Labs and World Bank for the period 2006 to 2020. The endogenous variable representing poverty was the International Wealth Index (IWI) and the core exogenous variable of concern was digitalisation (DIG) which composed of access to internet, mobile cell phone penetration and access to computer, indexed using principal component analysis. Other control variables included education (EDU), health (HEA), household size (HHSE), house quality (HSEQ), electricity (ELE) and urbanisation (URB). A correlation analysis to determine relationship, stylised fact analysis, Dimistrescu-Hurlin Causality to determine the causal effect, System General Methods of Moments (SGMM) to analyse impact, were harnessed to address the objectives of the study.

The results of the study showed that indeed there is a strong positive relationship between digitalisation and poverty, and a significant bi-causal relationship at (1%) significance level. Using the Haussmann test to gauge OLS, FEM, REM, and Arellano and Bond's Difference GMM estimator through Windmeijer conditions, an Arellano-Bover/Blundel-Bond SGMM estimation model was adopted which addressed the nature and character of data (T<30, N=150) scenario, and resolved the indogeneity and instrumentation as well as over identification issues arising from the data. The SGMM findings showed that indeed digitalisation is a significant determinant of poverty, alongside electricity, household size, and urbanisation at (1%) significance level. The Two Step SGMM provided an impact coefficient of digitalisation on IWI of 0.30, meaning that digitalisation indeed reduces poverty through a (30%) or a 0.30 marginal effect increase to IWI.

Pre-estimation tests carried included variance inflation factor for multi-collinearity, heteroscedasticity and stationary tests so as to validate the data. The pre-estimation tests resulted in the data being converted into logarithms, as well as prune education and asset variables as they suffered from serious multi-collinearity. The post estimation tests carried out included Sargan test for indogeneity, Wald test for panel significance, and Arellano Bond tests for serial autocorrelation which all produced plausible results. The study henceforth recommends policy makers to embrace digitalisation as an effective tool to reduce poverty, and efforts such as increase in investment in digital infrastructure,

appropriate taxation policies and price controls towards digital enablers, creation of a conducive environment for the digital sector to grow, amongst many initiatives. The findings are to provide valuable insights for policymakers, researchers, and practitioners navigating the intersection of digitalisation and poverty in the pursuit of inclusive and sustainable development and fight against poverty in Zimbabwe, from a provincial level, in the face of the unfolding fourth industrial revolution.

Keywords: *digitalisation, poverty dimension, correlation analysis, stylized facts, dimitrescu-hurlin causality, systems generalised method of moments, Zimbabwe*

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LIST OF ACRONYMS

AR ……	Auto Regressive
AU ……	African Union
CA……	Capability Approach
CALR……..	Center for Applied Legal Research Courier Services
DOLS……	Dynamic Ordinary Least Squares
EU……..	European Union
FEM ……	Fixed Effects Model
FGT……..	Foster-Greer-Thorbecke
FMOLS……	Fully Modified Ordinary Least Squares
GDP ……	Gross Domestic Product
GMM……	Generalized Methods of Moments
GNI……..	Gross National Income
HDI ……..	Human Development Index
HFIAS……..	Household Food Security Access Scale
ICES……. ……..	Income, Consumption and Expenditure Survey
ICT ……..	Information and communication technology
ICTPS……	Information and Communication Technology Postal and
IDT ……..	Individual Deficiency Theory
IGP ……..	Intergenerational Poverty
ILO ……	International labour Organisation
IWI……	International Wealth Index

MOPSE……	Ministry of Primary and Secondary Education
MPI ……..	Multidimensional Poverty
NECF……	National Economic Consultative Forum
OLS ……	Ordinary Least Squares
OPHI……	Oxford Poverty and Human Development Initiative
PICES ……	Poverty Income, Consumption Expenditure survey
POTRAZ ……	Postal and Telecommunication Authority of Zimbabwe
PPP……..	Purchasing Power Parity
PVI……	Private Voluntary Organisation
RBZ ……..	Reserve Bank of Zimbabwe
REM……..	Random Effects Model
SADC …….	Southern African Development committee
SASPEN……	Southern Africa Social Protection Expects Network
SDG …… …	Sustainable Development Goals
SDHI……	Sustainable Human Development Index
SE……	Social Exclusion
SGMM…….	Systems Generalized Methods of Moments
SME…….	Small to Medium Enterprise
SSA …….	Sub-Sahara Africa
TCPL ……	Total Consumption Poverty Line Transformation
UN……	United Nations
UNCTAD……	United Nations Conference on Trade and Development
UNDP ……..	United Nation Development Programme

UNECA ……..	United Nations Economic Commission for Africa
UNFPA……	United Nation Population Fund
UNWFP ……..	United Nations World Food Programme
WFP……..	World Food Programme
WHO …….	World Health Organization
ZBC ……	Zimbabwe Broadcasting Cooperation
ZIM-ASSET……	Zimbabwe Agenda for Sustainable Social Economic
ZIMSTA …….	Zimbabwe National Statistics
ZIMVAC …….	Zimbabwe Vulnerability Assessment Committee

CHAPTER 1: THE INTRODUCTION AND THE BACKGROUND

1.1 INTRODUCTION AND BACKGROUND SETTING

Digital technology is incessantly and hastily altering economic and social activities the world-over. Digitalisation presents both opportunities and problems for attainment of the Sustainable Development Goals (SDGs) (Assembly, 2015). The first SGD, which purports the ending of poverty and all its forms, remains a vulnerable challenge facing humanity (United Nations (UN), 2016:19). Despite the potential benefits provided by digitalisation since the year 2000 in improving the welfare of the poor by providing opportunities such as increases in social capital, access to information, the creation of economic opportunities, improving productivity and efficiency as well as increasing governance processes, inhabitants of the world have remained poor, with one billion two hundred million people being reported as being in the poor bracket (UN, 2016). Songwe (2020) highlighted that, of the 1.2 billion poor people in the world, about 600 million of them are found in Africa, Zimbabwe included. Songwe (2020) also indicated that (80%) of the poor in Africa dwell in marginalised communal non-urban areas, of which, Zimbabwe is largely rural, as agreed upon by the United Nations Population Fund (UNFPA) / Zimbabwe National Statistics Agency (ZIMSTAT) (2018:10). Digital deprivation may cause poverty through serious inconveniences in various spheres of life such as education, health, production, services, governance and in business etc. These serious inconveniences may lead to a spiral of events which results in people remaining trapped in the poverty domain. Digital deprivation influences nations' unemployment rates while also increasing inequities and financial demands, especially in rising and developing economies like Zimbabwe. This study sought to establish the relationship between digitalisation and poverty dimension in Zimbabwe, a provocative focus area which has never been researched in Zimbabwe's provinces, using a panel data analysis.

World economies are embracing the digital transformation agenda and fourth industrial revolution (4IR) in the face of pandemics such as COVID-19 (United Nations Conference on Trade and Development (UNCTAD), 2021; United Nations Development Programme (UNDP), 2020; Southern African Development Community (SADC), 2020). It is against this backdrop that digitalisation is important in forging ahead with successful digitalisation transformation in various facets of life. The ongoing research aims to examine the connection between poverty and digitalization, as well as various poverty dimensions, which include health, education, household size, house quality, electricity, asset ownership and urbanisation at the provincial level of a Sub-Saharan country, so that appropriate poverty alleviation government policies in

health, education and the general standard of living in the current digital era can be put in place.

The UNDP (2015) purported that the world embraced and adopted the multidimensional poverty index, commonly known as the (MPI), which was based on 10 poverty indicators crafted from three dimensions, namely health, income and education. However, the Oxford Poverty and Human Development Initiative (OPHI, 2020) indicated the need to revise the MPIs and hence opened up the multidimensional poverty index post-2015, known as MPI 2015+, which is meant to complement the three poverty dimensions and show how the different and extra dimensions of poverty interconnect and overlap. It is against this backdrop that the quest to investigate the relationship between digitalisation and poverty has expanded to other poverty dimensions to fill a research gap, with the possibility of adding digitalisation as a poverty dimension to the MPI Post 2015. Jennings and Oldiges (2020) coined that the headline poverty indicator adopted by the UNDP for the MPI 2015 was pegged at US$1 per day, but the Post 2015 MPI headline indicator was suggested to be pegged at US$1.25, and is still open for improvement, which this study has an opportunity to contribute to. OPHI (2022) purported that eradicating poverty in all its forms requires extra dimensions, hence the Multidimensional Poverty Peer Network (MPPN), using its enhanced survey modules, proposed that the 2015 development goals should include an integrated MPI measure which will draw attention to the various bundles of deprivation. This generates a gap for the current study to analyse, and includes digital assets' deprivation aspects.

SDG number 9 of 2015 purports that *"there is a need to ensure that the benefits of new technologies, especially ICT are made accessible for the success of sustainable development".* This connotation speaks to the SDG goals, and as such, brings to the table the need to investigate how accessible the digitalisation technologies are to the people of Africa, using the case of Zimbabwe. Songwe (2020), in her UNCTAD (2020) report, noted that digitalisation is one of the most powerful tools for the implementation of the 2030 Agenda for Sustainable Development in Africa. SADC economies are embracing a digital transformation agenda in line with the Africa Union Digitalisation Agenda. According to Songwe (2020), digital applications drive socioeconomic transformation by increasing efficiency in the production and distribution of goods and services, opening up opportunities for income generation for millions of poor people, and improving connectivity between people, governments, and organisations. Against this environment, digitization is critical for Africa.

According to UNCTAD (2020), (80%) of Africa's population owns a mobile phone. With a share of GDP of (5%) (UNCTAD, 2020), the digital economy is quickly becoming one of the most important drivers of development. However, UNCTAD (2020) notes that Africa is still the least

connected region of the world with about (28%) internet coverage and (34%) access to broadband. Most informal traders, (60%) of men and (75%) of women in Africa, are in need of digitalisation to carry on their economic activities. The advent of COVID-19 in 2019 affected most businesses and only digitalisation and having digital identities for all could help ensure that development and wellbeing is sustainable. Zimbabwe has seen an increase in information and communication technology (ICT) usage post-2000. The World Bank (2021) pointed out that in Zimbabwe in 1997, the mobile subscription uptake was 0.04 per 100, but by 2020, the rate had increased to 88 per 100 people, showing a very sharp increase. However, the GDP per capita in the same period was found to be decreasing, which posits an inquiry into whether ICT is in fact causing a decline in the standard of living or not. Recent research by Akinboade *et al.* (2021), Yang *et al.* (2021), Mateko (2022) and Olamide *et al.* (2022) pointed to the notion that ICT positively affects poverty reduction, although their scope was not on Zimbabwe per se. This creates the need to empirically investigate this controversy by analysing the relationship between digitalisation and poverty in Zimbabwe's provinces.

The African Union (2020) reported that the 2020 to 2030 digitalisation agenda hinges on securing a digital single market by 2030, which implies that all people should be digitally empowered and able to access safely and securely 6 megabytes per second. The African Union (2020) called for a harmonization of policies, legislation and regulations, as well as improved digital networks. The African Union (2020) yearns to create a digital industry, digital financial system, digital education, digital health and digital agriculture, etc. The researcher believes that for the successful implementation of the 2020 to 2030 agenda, the African Union needs to understand firstly how households are digitally poor; the nature of the digital poverty they have; the intensity of the digital poverty; variability in digital poverty; and how an increase in digitalisation affects the poor. This study will analyse the relationship between digitalisation and poverty dimensions in the provinces of one of the Sub-Saharan African Countries, which will provide well-informed policy insights into the erstwhile digitalisation agendas in the region.

Several studies in Zimbabwe have been published, attempting to explain the need for ICT (digitalisation) in Zimbabwean societies, especially in schools and in organizations and organizational processes (Konyana & Konyana, 2013; Musarurwa, 2011; Ngara, 2019; Ngwenya, 2018), but these are limited in terms of the relationship that ICT has with poverty. Konyana and Konyana (2013) investigated the computerization of rural schools in Zimbabwe and forwarded the need to introduce Computer Studies in Schools, especially in rural schools where most Zimbabweans are found. Konyana and Konyana (2013) discovered that the access to ICT gap was huge between urban and rural schools, and that the Government's attempt to provide computers in schools was challenged by some lack computer trainers,

electricity, as well as the readiness of the community, which all left the computer equipment and accessories lying idle in rural schools. However, this study will further fathom the analysis by looking at all digitalisation gadgets, uses and the intensity of deprivation for all society members, not only school children, as in Konyana and Konyana's (2013) work. Ngara (2019) acknowledged that ICT usage was lacking in most Zimbabwe Open University students in teaching practice. Ngwenya (2018) propounded that the attitudes of ICT users, acceptance and competence were important for ICT uptake by students. This study will analyse the relationship between digitalisation and multidimensional poverty in the provinces of Zimbabwe.

On March 29, 2012, the then-President of the Republic of Zimbabwe pronounced openly that "*every Zimbabwean child should be computer literate*", which was an erstwhile and forward reasoning vision. However, Konyana and Konyana (2013) identified that there was a lack of access and consistent electricity in rural schools in Zimbabwe, which makes the teaching of ICT a constraint. Ngara (2019) highlighted that even university students faced limited access to electricity for their ICT gadgets. The researcher therefore suggests that if schools and universities are not having sufficient access and consistent electricity as purported by Konyana and Konyana (2013) and Ngara (2019), then rural households are transitively worse off. Zimstat (2017) stipulated that rural provinces such as Matebeleland North and South, Masvingo and Mashonaland West had high rates of poverty of between (40%) to (70%) per 100 households. Interestingly, the same rural based provinces were observed to have low to moderate rates of owing digital assets such as smart phone and or a television (Konyana & Konyana, 2013) This study will dwell on poverty, poverty dimensions and digitalisation, which is indexed using the principal component analysis of cell-phone uptake, access to the internet, access to computers and access to television, using secondary data from 2006 to 2020 on the ten provinces of Zimbabwe.

Traditionally, Zimbabwe has been using a poverty datum line to indicate poverty per family which can afford a standard breadbasket. However, OPHI (2013) investigated and communicated that the percentage of poor people in Zimbabwe in 2003 was (72%) according to the poverty datum line based on income, but in 2011 the statistics showed that (39.1%) were MPI poor, which is marginally high statistics. OPHI (2020) indicated that the proportion of the population that is multidimensionally poor was (25.8%), while the average proportion of dimensions in which poor people are deprived was (42.6), which yielded a national MPI of 0.110 or (11%) using the Global MPI. Zimbabwe's rural population had an MPI of 0.15, which was considerably higher than the urban MPI, which was at 0.018. Comparably, Sub-Saharan Africa had an MPI of 0.28, which is on the upper side according to OPHI (2019). However,

ZIMSTAT (2020) maintains that, on the ground, (76.3%) of people in Zimbabwe are in poverty using the poverty datum index. This reveals a research gap in the disparity between the Global MPI and the ZIMSTAT statistics, which this study may bridge by utilising the international wealth index as a proxy for poverty, which comprehensively harnesses this real-life phenomenon.

Despite poverty being defined and measured in several ways (UNDP, 2010; UNCTAD, 2019; Chakravarky & Bourgnignoa, 2019; Aryakwa *et al.*, 2021; Gaba *et al.*, 2021; Dunga, 2021), it is arguably relevant that the dimensions and definitions of poverty have been evolving over time, generations and trends. According to the Bible, Genesis 13, verses 1 to 2, Moses measured Abraham's wealth in terms of gold and livestock, and the person who had no such endowments was considered poor. Shaw (1984), in his narrative about Marx and Morgan's life in primitive communalism and feudal communities, advanced that land, precious metals and livestock were a measure of wealth, and not having such collections was deemed poor. Smith (1776) advised that capitalistic societies regarded the ownership of factors of production such as land, labour, capital and entrepreneurship capability as wealth. Thus being deprived of any or all of that meant that one was in the poverty domain. This study will utilise the international wealth index (IWI) as a measure of poverty. The causal relationship between IWI as a proxy for poverty and a digitalisation composite index obtained from access to a cell phone, access to the internet, and access to a computer is the main focus of the investigation.

Beyond the year 2000, world societies embraced information and technology as a need whose ownership and use would enrich societies and provide better well-being (UNCTAD, 2000). This stage of development became known as the millennial age, internet age, ICT age, or simply the computer age, where every household, every production line and every economic activity, government or private organizational process are hinged on digitalisation (UNDP, 2019). The advent of COVID-19 in 2021 exacerbated the need to use digitalisation when working from home became a norm, and online resources became a real need more than ever (World Health Organisation (WHO), 2020a, 2021). The ownership, use and access to digitalisation became a fundamental need, and the crux of the matter is whether the economic agents have sufficient know-how, ownership, use and access to digital assets in the context of Sub-Saharan African societies such as Zimbabwe. In this study, poverty is to be measured using the international wealth index (Smit & Steendijk, 2015). The objective of this study is to investigate the association between digitalisation and poverty.

A number of studies have been conducted on poverty and ICT, such as those of Ma *et al.* (2018), Masango (2018), David (2019), Martinez (2020), Alimi and Okunade (2020), Akinboade *et al.,* (2021), Mateko (2022), Olamide *et al.,* (2022), etcetera, but they were not

exploring the digital dimension and poverty at a provincial level. Their considerations of poverty measures dwelt on aspects such as the human development index, family household income, and real GDP per capita, to mention but a few. Caceres (2007) in Peru, Muzareba (2016) in Bangladesh and Yang *et al.* (2021) in China have researched digitalisation-associated poverty using multidimensional poverty, which aligns with this study. However, their methodology, location and focus sample observations are different from this current study. This study dwells on how poverty is associated with digitalisation, as well as other aspects such as education, health, household size, house quality, urbanization, electricity and asset ownership, using secondary data for the ten Zimbabwe provinces.

1.2 PROBLEM STATEMENT

Poverty has existed for a long time and still exists in a huge number of countries around the world. As a result, in many nations, poverty alleviation targeting is still an essential real-life policy concern. To comprehend the danger that poverty poses, one must first comprehend the scope of poverty and the mechanism by which it appears to be deepening. Failure to understand and analyse the scope and causes of poverty can lead to serious consequences such as death to men, women and children. One major aspect is digitalisation, which may cause poverty if one is deprived of access, connectivity and information, as evidenced during the COVID-19 era, where those who had no access to digital technologies for informative and communicative means upon being infected were ruinously affected (WHO, 2020a). There is the potential existence of a strong possible bi-causal relationship between digitalisation and poverty dimensions, which are health, education and well-being (OPHI, 2015), especially in this digital era. This study seeks to prove the causality relationship. Barrantes (2005) analysed ICT demand and attempted to measure digital poverty using indicators that included information, connectivity and communication. Barrantes (2005) contributed significantly to the ideas around digital poverty. However, this study fathoms further by analysing the relationship between poverty and digitalisation in Zimbabwean provinces.

Zimbabwe has recorded a tremendous increase in digitalisation from 1998 to 2020 in the form of high usage mobile phones, telephone and internet usage in Southern Africa. On the other hand, Zimbabwe has continued to be devastated by extreme poverty, more especially from the era of land redistribution in 1998 up to 2022. In 2019, Econet Zimbabwe pointed out that eight million out of thirteen million Zimbabweans have subscribed for its mobile money called Ecocash alone, yet the industry boasts also of Netone and Telecel who are competitors (POTRAZ, 2020). The World Bank (2023) indicates that in 2000, Zimbabwe had an average of two people per 100 in terms of cell-phone use, but by 2020, the ratio had drastically shot to 84 people per 100. The Zimbabwe Government utilized its draft ICT policy of 2015 to distribute

computers to schools, especially rural schools. The Zimbabwe Broadcasting Corporation, ZBC (2019), stated that news spread through television was popular amongst urbanites, pointing to the high uptake of television services through internet applications such as YouTube and Facebook in Zimbabwe. The data from Global Data Labs 4.2.1 (2023) indicates a general increase in the rates of digitalisation in the form of cell-phones and the internet in Zimbabwe for the period post-2000 up to 2020.

On the other side of the coin, SADC and its member states, including Zimbabwe, have been battling with poverty. Zimbabwe's GDP growth was (12.02%) in 2009, but by 2020, it was minus seven (75%) (World Bank, 2023). The international wealth index for Zimbabwe was (63%), but in 2020 it had dropped to 59 (Global Data Labs, 2023). Poverty in Zimbabwe has been on the increase. The main problem henceforth is whether digitalisation and poverty have an association, and if the relationship is there, which one causes the other. This is the main purpose and rationale for this study.

The argument on ICT, which in this study is regarded as digitalisation and poverty, has been studied previously and produced mixed results. This study participates in the debat, using empirical facts to be obtained in Zimbabwe provinces. Akinboade *et al*. (2018), for instance, showed that ICT access is positively associated with household food security, which is a poverty component, while Olamide *et al.* (2022) agree that poverty, information and communication technology have a relationship which even extends into the long-run. Mateko (2022) found that ICT usage actually reduces poverty, meaning that there exists not only a relationship, but a causal one at that. However, Yang et al. (2021) revealed the ICT element of mobile internet that it has a negative and significant impact on multidimensional poverty. Yang *et al.* (2021) agree that the relationship is there, although the effect differs much with Mateko (2022), Akinboade (2022) and a host of others. The debate opens room for a gap to be pursued, and controversies empirically expedited for one of the Sub-Saharan countries, using a provincial panel data analysis.

1.3 STUDY'S OBJECTIVES

1.3.1 Primary objective of the research

- To investigate the relationship between digitalisation and poverty dimensions in Zimbabwe.

1.3.2 Sub-objectives of the study

- To examine the nature of the relationship between digitalisation and poverty in Zimbabwe's provinces;

- To investigate the causal relationship that exists between digitalisation and poverty in Zimbabwe; and
- To evaluate the effect of digitalisation on poverty in Zimbabwe.

1.4 QUESTIONS RELATED TO THE RESEARCH

1.4.1 Empirical research questions

The main research question is:

- What is the relationship between digitalisation and poverty in Zimbabwe?

The secondary research questions are:

- What is the nature of the relationship between digitalisation and poverty in Zimbabwe's provinces?
- What causal relationship exists between digitalisation and poverty in Zimbabwe?
- What is the effect of digitalisation and poverty in Zimbabwe?

1.4.2 Theoretical research questions

- What are the poverty theories and their relevance to this study?
- What literature is there on digitalisation in developing economies and their relation to poverty dimensions?
- What digital policies exist in Zimbabwe?
- How is poverty measured in line with the UNDP MPI from various literature?

1.5 SIGNIFICANCE OF THE STUDY

1.5.1 Addition of digitalisation poverty to MPI

The UNDP (2021) postulated that there are three broad categories of the Multi-Dimension Poverty Indices, which consist of three dimensions including Health, Education and Income, and ten indicators. This study will succinctly add another poverty dimension in the name of Digitalisation, which will have four indicators supporting it. Hence, the newly modelled MPI model will have four dimensions and thirteen indicators as shown in Table 1.1.

Table 1.1: Multidimensions of Poverty

DIMENSION OF POVERTY	INDICATOR
Health	1. Nutrition
	2. Child Mortality
Education	3. Years of Learning
	4. School Attendance
Income	5. Cooking Fuel
	6. Sanitation
	7. Drinking Water
	8. Electricity
	9. Housing
	10. Assets
Digitalisation	11. Mobile phone penetration
	12. Access to landline phone
	13. Access to the internet

Source: Author's own Calculation (2023)

1.5.2 Human insecurities debate

The Human Development Report (1994) lists 7 human securities which are in line with deprivation and human poverty dimensional aspects. In this regard, the following are human insecurities:

- Economic Security;
- Food Security;
- Health Security
- Environmental security;
- Political Security;
- Community Security; and
- Environmental Security.

The researcher, however, reasonably aligns these insecurities to human needs, and if a human is deprived of these securities, they may equally fall into the poverty trap. This study therefore contributes to this ideology of human insecurities, digital security, which will have indicators such as digital inequality, digital power connection, digital job precariousness, digital data attack/fraud, digital access, etc. This research adds to what UNCTAD's (2020) human insecurities debate is based upon.

1.5.3 Digitalisation policies (Digital Transformation Policies)

Zimbabwe announced that it was embracing digital transformation in 2012 and embarked on the supply of computers to schools, especially in rural schools (Musarurwa, 2011; Zindi, 2011; Ngara, 2019). The digitalisation transformation implementation results were a mixed bag in terms of outcomes. The tenets of this study will strongly provide sufficient awareness with respect to the identification of digitalisation capabilities, and digitalisation situational ground requirements that would go a long way towards establishing who needs the assistance, who is digitally deprived, the intensity, the variability and the nature of deprivation. One may have purely asked a question such as, *"Why will a President supply computer to a rural school without electricity?".*

1.5.4 Addition to multi-dimensions of poverty

This study will also fill a gap whereby previous studies had left out the digitalisation of poverty as a dimension. Much research worldwide had enlisted socio-economic dimensions of poverty as being major. However, as economies embrace the digital transformation and the fourth industrial revolution, digitalisation becomes a basic need whose index in terms of how wealth or poor as an entity is vital for strategy and policy making. Various governments, corporates, humanitarian organizations, regional and global economic and trade blocks, as well as all societies, need to embrace this school of thought as the calendar year's drift into the digital century.

1.6 CHAPTER LAYOUT

This study comprises the following chapters:

Chapter 1: Introduction and Background

This chapter introduces the study, the problem statement, the theoretical perspectives and framework, research objectives, and a brief description of the research design and methodology. The chapter goes on to point out ethical considerations, the contribution of the study and a chapter classification for the rest of the study.

Chapter 2: Theoretical aspects of poverty and digitalisation

Chapter 2 will present theoretical aspects of poverty and digitalisation. The chapter will discuss applicable definitions of poverty, both unidimensional and multidimensional, and digitalisation, and proceed to theoretical frameworks of poverty and digitalisation. It will then explore

theoretical aspects of the measures of poverty and measures of digitalisation. Theories on perceptions of poverty will also be provided, and a conclusion will wrap up the chapter.

Chapter 3: Empirical overview of poverty and digitalisation

The chapter will look into various empirical literature behind poverty and digitalisation. The chapter will use a funnel top-to-down approach to present studies done from a global perspective down to the province of concern. Thematic empirical studies will be reviewed and gaps established in line with poverty and digitalisation and/or ICT.

Chapter 4: Research methodology

Chapter 4 describes the research design and methodology used to collect and analyse data. It describes the data used in the study. It will dwell upon the descriptive and quantitative research analysis, as well as the primary research focus to be carried out. Details about the research design, model, diagnostic tests and model tests will be explained. Some empirical models will be presented, such as Multiple Logistic, as well as their diagnostic tests. Perceptions of the poverty model will also be presented.

Chapter 5: Stylised facts analysis on Zimbabwe

Chapter 5 explores and presents the stylised facts of all the variables included in the model. The variables present are poverty as proxied by the international wealth index, and its sub-categories, which are the poor, poorer and poorest, digitalisation and its three delineated aspects, namely computer, cell phone and internet, then education, health, household size, house quality, electricity, asset ownership as proxied by fridge and motorbike and urbanization.

Chapter 6: Results and findings

Chapter 6 presents the results, along with a detailed discussion of the findings. It compares the results of different methodologies and different models, which will have been presented in Chapter 4.

Chapter 7: Summary, conclusions and recommendations

Chapter 7 presents summary findings and general conclusions from the results guided by the objectives of the study. The chapter expands on policy recommendations, and areas for future studies.

CHAPTER 2: THEORETICAL ASPECTS OF POVERTY AND DIGITALISATION

2.1 INTRODUCTION

This chapter covers the theoretical aspects of poverty and digitalisation in the endeavour to explore past theoretical literature, which is important in buttressing this study focusing on analysing the relationship between multidimensional poverty and digitalisation in Zimbabwe. The chapter broadly covers definitions, theoretical aspects on digitalisation and poverty, as well as theoretical detail son measures of poverty (unidimensional and multidimensional) and of digitalisation. This chapter defines poverty from early proponents who include Sen (1976) and Bellu and Liberati (2005) up to contemporary definitions by advocates such as Alkire and Foster (2011b), Dunga and Grobler (2018), Balland *et al.* (2022), etc. Defining digitalisation and poverty both in its singular and plural measures is crucial in this study as it formulates baseline ground for take-off on the research. The chapter will expound on digitalisation poverty in line with Barrantes (2007) and the discussion which makes it superior to ICT poverty, despite its strong relation to ICT.

Unpacking theoretical constructs on the relationship between digitalisation and poverty was made possible by chronologically visiting past theoretical efforts on innovation by Schumpeter (1911), Pocock's (1957) Social Exclusion theories, Lewis' (1966) Culture of Poverty theory, Doerienger and Piore's (1971) Dual Labour Markets, Sen's (1976) Capability Approach, Gans' (1965) Individual Deficiencies theory, Simon's (1978) Decisions-Based Theory and Laderchi *et al.'s* (2003) monetary approaches. Theoretical views on perceptions of poverty by Feagin (1972) are also presented. The theories on measures of poverty are thematically discussed using the monetary approaches, social exclusion, capability and participatory approaches, whereas the multidimensional measures of poverty theoretical aspects were unpacked using the Alkire and Foster (2011), Burguignon-Chakravarty (2003), Human Development and UNDP MPI multidimensional facets. The chapter ends with detailing the measures of digitalisation in line with Barrantes (2007).

As the theoretical expositions take precedence, it goes without mention that the concept of poverty is a contested domain. Dunn (2022) advised that the definition of poverty has much to do with the philosophy a person subscribes to. Scott (1994:17) agreed to the same, pinning on that the definition of poverty is up for debate. In this regard, every analysis of poverty must start with the fundamental question of how poverty is defined and who should be included in the category of the poor, or simply how poor is the poor, or how and why they are excluded or included in the poverty domain. Alcock (1993:67) noted that the definitional issue continues to

be at the core of the effort to understand poverty. Academics and industry leaders have proposed a variety of parallel definitions and measures of poverty over time. The debate has been divisive up to this point, and yet still ended up creating schools of thought where some hinged on unidimensional and others on multidimensional. All definitions of poverty share the fact that they all consider poverty to be a situation in which a decent level of life is not achieved, and all consider that poverty is an undesirable social ill, hence unwanted by all people. There has been a synthesis of the many viewpoints as coined by the World Bank, which are detailed in this Chapter. The following section attempts to stretch the breadth of definitions and theories which address measures of digitalisation and poverty by various authors.

2.2 DEFINING POVERTY

The definition of poverty depends on the angle one is cascading from (Dunn, 2022). Depending on the topic or discourse being studied, the word *'poverty'* can be thought of as having a collection of many conflicting meanings. The World Bank (2015:9–10) created a synopsis of the different positions, such as the lack of or the inability to attain a socially acceptable standard of living, as all pointing to poverty. Three crucial terms in this formulation merit special emphasis which are '*lack of';* '*inability'*; and *'standard of living'.* Bellu and Liberati (2015) propounded that the fundamental circumstance for the concept of poverty is a '*lack of*' access and control over economic resources. For instance, a person may be considered poor if they do not have access to basic necessities like food or shelter or, conversely, if they do not have the money to buy them. '*Lacking'* is synonymous to '*deprivation'* of something which is a necessity, and if one is to ask an urbanite their most valued necessities, other than Maslow's needs, they do have digitalisation needs, information requirements and the need for social media affiliations, etcetera.

According to Sen's 1985 idea, poverty is always connected to the '*inability'* to engage in society. The ability to function is what Sen (1979:40) refers to as the capability. It stands for the different functional combinations that a person is capable of. Functioning describes what a person is or does, whereas capabilities describe a person's capacity to carry out functionings (Sen, 1985:10; 1987:36).

Functionings might be simple (such as providing food and shelter) or sophisticated (such as self-respect, freedom, social inclusion). The person is poor if they are unable to perform these functions. Bellù and Liberati (2015:2) used the example of how disability not only reduces the ability to earn money (which alludes to the lack of control over economic resources), but also makes it exceedingly difficult to convert revenue into resources, even if it is possible to do so

in terms of income. This led Bellù and Liberati (2015:2) to define poverty as a circumstance symbolized by levels of capability that are intolerably stumpy compared to the society.

Belu and Liberati (2005) propounded that poverty may be determined by what is regarded as a generally tolerable '*standard of living'* at a certain moment in a particular society. For instance, using public transportation in a country where owning a car is the norm may be a sign of poverty. Not having a television may also be a symbol of poverty in a highly technologically advanced civilization, yet in certain other cultures it is a luxury, whereby being poor is represented by not owning an asset such as car.

The overarching issue of defining poverty has not been fully resolved despite the fact that the definition presented by Belu and Liberati (2005) attempted to unite several methodologies to poverty. Whether poverty should be understood as a multidimensional phenomenon or merely in terms of money alone has been expedited by Dunga (2021), who pointed out that poverty is a multifaceted creature whose various dimensions are all important in addressing the poverty concern. The current study emphasizes that poverty never originates from the absence of a single thing, but rather from a myriad of connected elements that accumulate in the experiences of those living in poverty. There is currently consensus amongst academics (Alkire & Foster, 2011b; Dunga & Grobler, 2017, 2018; Dunga, 2021) that poverty is multidimensional.

By using measurements like the human development index (HDI) and human poverty index (HPI) that take into consideration other facets of human development, such as health and education, the UNDP's human development report defines and offers statistics that show the variety of poverty realities. The World Bank (2020) continues to use the unidimensional monetary strategy despite understanding that poverty is a multifaceted problem. Determining which dimensions to include and who should be considered is a problem that arises in the multidimensional approach (OPHI, 2015). Hence this study puts digitalisation as a dimension, more especially with the advent of the fourth industrial revolution, to be inculcated in the multidimensional poverty framework.

Beegle *et al.*, (2016:6) espoused that poverty is characterised by the complete lack of opportunities, acute undernourishment, hunger, illiteracy, access to education, financial immobility, inadequate socioeconomic and political mobility, physical and mental sickness, and social instability. Poverty, therefore, may result in people not having access to the social, economic and political opportunities that are required to raise living standards. Social exclusion is thought to be the result of insufficient information dissemination due to the vast distances across African cultures. However, with the correct digitalisation device and

capability deployment, informational barriers might be surmounted. The relationship between digitalisation and multidimensional poverty in Zimbabwe's ten provinces is the core matter of this study.

There are disagreements on the choice of pertinent indicators, the choice of the 'bottom line' in terms of overall dimensions and for each indicator in the analysis of poverty (Quizilbash, 2004; Dotter & Klasen, 2017; Gaba, 2021; Dunga, 2021; Vollmer & Alkire, 2022; Firdausy & Budisetyowati, 2022). Only a few examples of indicators include educational literacy, inadequate nutrition, housing, clothing, safety, health, income, sanitation, and access to clean water, however this being not an exhaustive list. According to Dunga (2021), some factors affect poverty more than others depending on the location and period. Vertical vagueness alludes to the degree at which an individual must fall in order to be classed as poor or not poor, whilst horizontal vagueness refers to a lack of precision on a range of poverty-related factors. The inconsistent distribution of poverty on the horizontal and vertical axes symbolises the multidimensionally poor (Balland et al., 2022).

Horizontal ambiguity has been cited as a problem emanating from unidimensional measures of poverty. According to Balland *et al.* (2022), horizontal ambiguity may be important when poverty is determined by the amount of income required to avoid a particular degree of deprivation in accordance with a predetermined set of deprivation dimensions. When other poverty indicators, such the cost of food, shelter and energy, are taken into account when defining the poverty line, this happens (Van der Walt, 2004). To accurately differentiate between those living in poverty and those who are not, it is crucial to take vertical ambiguity into account when establishing the income poverty line—the absolute minimum income level necessary for a person's livelihood (Van der Walt, 2004:8). This uncertainty regarding poverty persists and remains a substantial factor in the ongoing discussion and challenge of measuring poverty.

2.3 DEFINING MULTIDIMENSIONAL POVERTY

It has long been acknowledged that poverty is a multifaceted condition that plagues the entire human species (Alkire & Foster, 2011b; Lustig 2011; Ravallion 2011; Dunga & Grobler, 2017; Dunga & Grobler, 2018; Dunga, 2021). Earlier on, Aristotle's definition of poverty incorporated the concept of multidimensionality as he proposed that happiness, pleasure and prosperity, which entail the absence of poverty, are related to welfare and wellbeing. Aristotle (1994:34) postulated that the idea that fits within an account is that a happy person leads a successful life. This is because people have defined happiness as leading a successful life and making use of opportunities. The qualities deemed essential to happiness appear to be present in all

of the traits perceived by people as happiness. Lustig (2011) noted that happiness is associated with virtue, and Ravallion (2011) identified happiness with practical wisdom, yet Balland *et al.* (2022) pointed out that happiness is associated with a certain kind of philosophical wisdom.

The definitions of poverty have evolved over time since time immemorial. Earlier authors of economics such as Smith (1776) had a definition of poverty which included non-financial elements such as unfavourable social conditions, suffering, illness, hunger, safety from hurt and injury amongst many aspects. Sen (1976) ignited the multidimensional version of definition of poverty in the Capabilities Theory. Sen (1999) advocated for deprivation of essential capacities instead of only low income earnings. O'Connor (2001) agreed to Sen (1999), however, added inequality and disparities of economic status and political power.

Sen (1999:87) described capacities as the significant liberties one enjoys living the kind of life one values. Hassel *et al.* (2023) describes poverty as the denial of essential human necessities and happiness, whereas the United Nations Human Development Report (1998) defines poverty as resource shortage and the deprivation of normal life choices for a fair living. Slattery (2018) defines poverty as the unpleasant circumstances that people must face, and then contrasts the lives of those who are poor and those who are not.

The term 'multidimensional poverty' as used by UNICEF (2004) is strongly tied to being deprived of one's abilities in intrinsically valuable areas of one's life. Sen 1976's Capabilities Approach describes poverty as a multidimensional deprivation of possessions by people, households or nations to meet the sustainable requirements of life, rather than just a lack of money. Under the Theory of Poverty is where the Capabilities Approach is further discussed. Sen's definition of multidimensional poverty is acceptable by a number of academics and organizations, including the UNDP, who have expanded on the idea. Poverty has been extensively defined in terms of its multidimensionality in line with Sen's Capabilities framework (UNDP, 2020, World Bank, 2020).

The UNDP (2020) propounded that multidimensional poverty is the deprivation of access to opportunities required for human sustenance. Aspects such as standard of living, freedoms, dignity, and respect of people promotes human decency and development. UNDP (2020) interlinked that deprivation of people's choices with human development through the human functionings.

The World Bank (2020) defines poverty as a deprivation of human psychological needs which include food, shelter, safety and health at a certain time. The definition also includes similar

deprivations to family members or society which one lives in. Death of family members, illness, lack of sanitation, lack of freedoms also adds to the list of human needs as propounded by WHO (2020).

The United Nations (2020) further stipulates that low incomes and lack of political voice because social support structures are absent or deprived points to poverty. Unequal opportunities, information asymmetry, etcetera adds to poverty. United nations (2020) highlights that deprivation of political and social authority stands out as the greatest manifestation of poverty in developing third world economies.

African Development Bank (2019) using the multidimensional poverty index indicated that Zimbabwe suffered from deep poverty in the era from 2008 up to 2012, where aspects such as access to food, health, education, housing and employment were scanty to the people of Zimbabwe. According to ZIMSTAT (2020), Zimbabwe uses the consumer price index versus the bread basket to gauge poverty, which somewhat leaves more dimensions of poverty unattended to, as forwarded by United Nations (2020). United Nations (2020) stipulated that multidimensional poverty in Zimbabwe is very high in rural communities than in urban areas, especially in post 2000 era.

The aforementioned claims necessitate additional research on multidimensional poverty utilizing a wider range of parameters. Academics globally have envisaged that poverty is better understood as multifaceted as opposed to unidimensional (e.g., Dunga, 2014, 2016, 2017; Dunga & Grobler, 2017; Nwosu, 2018), and the effects have been bedevilling global citizens for a long time. It is an undesirable phenomenon that has a wide range of financial and non-financial effects on humans. All things considered, poverty can be ended. Since the beginning of time, poverty has prevented people from fully appreciating and being satisfied with their lives. Poverty covers a range of necessities that are constantly needed for human survival, along with misery, physical suffering, a lack of freedoms, and access to high-quality services and goods.

2.4 DEFINING DIGITALISATION AND DIGITALISATION POVERTY

Digitalisation is defined by Tilson, et al. (2010:749) as the technical process of up-taking the usage of innovative digital technologies to the community of users. These digital technologies include but not limited to computers, cell phones, internet, etcetera. In this regard, digitalisation is more superior to ICTs because digitalisation is the application of digital technologies and infrastructures to the socio-economic wellbeing of a society. Digitalisation is thought of more as of a transformative impact produced by ICTs other than simply having entitlement or possession of the ICT gadgets (Tilson, Lyytinen, & Sørensen, 2010:749). However, the

researcher asserts that having ICT gadgets is a baseline enabling situation which perpetuates digitalisation, and hence the research questionnaires will triangulate respondents in terms of having, usage and impacts brought by ICT gadgets and ICTs know-how. In this research, mobile penetration, access to internet and access to landline will proxy digitalisation.

However, literature is awash with articles where some interchangeably use the terms digitization instead of digitalisation. Bloomberg (2018) defined digitization as the process of transforming information into a digital (computer-readable) format. The end result is the representation of an object, appearance, sound, document, or signal (often an analogue signal) generated by generating a series of integers that describe a discrete set of points or samples.

Digitalisation poverty is the deprivation or lack of digitalisation environments or platforms which can transform a person or society using the digital or ICT gadgets (Barrantes, 2007). To understand digitalisation poverty or any type of poverty, a threshold must be established, in this case along a continuum of potential ICT product and service consumption. With this knowledge, it is intriguing to talk about the economic idea of demand before describing the conceptual framework. According to Ivars-Baidal *et al.* (2019), the benefits of ICTs include that the data can be saved, made available, used and consumed by digital media, and that is what users primarily are concerned with when discussing digitalisation poverty. As a result, this study is adding a new dimension, which is the use of computer technology or, more broadly, digital communication technologies that increase the usefulness of the equipment (such as the cameras, phonebooks, music players, etc. that are now included in mobile phones).

According to Ivars-Baidal *et al.* (2019), people who lack access to digital technologies' information and communication do so because they lack the skills to use them, the resources to do so (a demand consideration), the capability, and the opportunity to have the ICT gadgets and expertise. Although technologies are the means, their availability is also the most obvious aspect of the demand that can be measured.

Barrantes (2007) argues that people who lack access to or use of ICT are considered to be digitally poor. These people may not just be low-income or have unmet fundamental requirements, but they may also include those who, based on their economic circumstances, would not be considered to be poor. There are thus various categories of those who are digitally poor, as shown in Figure 2.1.

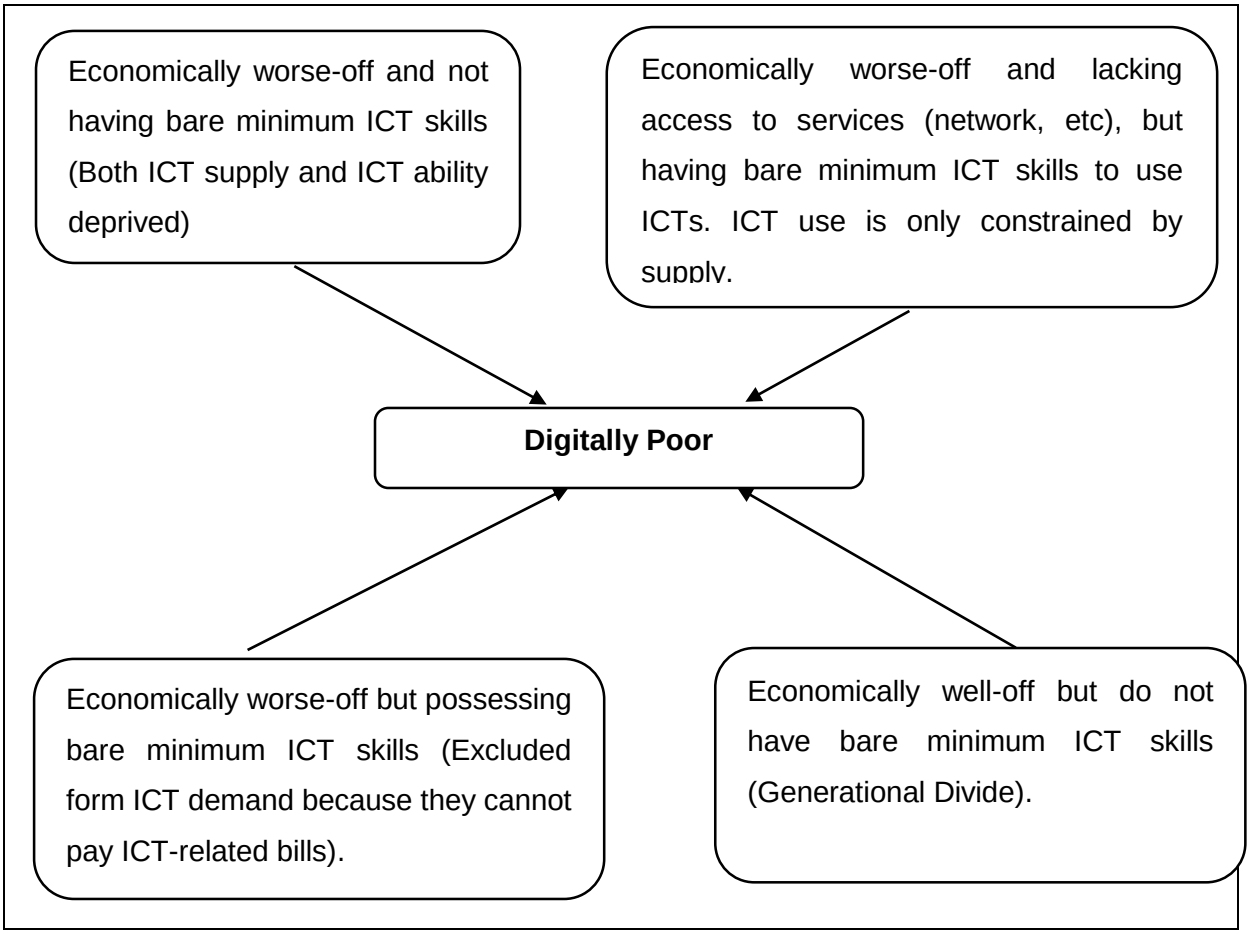

Figure 2.1: Digitalisation Poverty
Source: Author's own Calculation (2023)

When considering this approach as shown in Figure 2.1, low-income excluded sectors are not only those with low digital literacy. People who do not use digital devices may be digitally poor because they lack services or find these difficult to utilise. Four variables are used to define digitally underprivileged people, namely:

- **Age** – According to the theory, a person's likelihood of becoming digitally poor increases with age. It serves as a gauge of human capital.
- **Instruction** – According to the theory, a person is less likely to be digitally impoverished the higher their educational degree. It is the most typical method of assessing human capital.
- **Infrastructure / economic** – considerations include radio, open television, fixed and mobile phone services, cable television, computers, and Internet connectivity.
- **Functionality that was achieved** – Functionality describes how technology is put to use, from the simple act of receiving information to the complex interaction required for

computerized transactions for business or government purchases, as well as the production of content.

If the taxonomy is to be useful, it cannot be strict. Age and economic destitution are two criteria that enable a more adaptable taxonomy. On the one hand, young people who are struggling financially and live in places without connections (a supply issue) cannot reasonably belong at functionality level even though they may be perfectly capable of using ICTs actively. On the other hand, because older individuals typically have difficulties learning, it is challenging to classify elders who are not bad at the functionality level. In this study, respondents who lack access to mobile phones, access to the internet and access to a landline will be digitally poor.

2.5 POVERTY AND DIGITALISATION CONCEPTS

The concept of poverty and digitalisation has since been discussed by early theorists such as Schumpeter (1911), Pocock (1957) and later post the year 2000, by Laderchi *et al.* (2003) and Ravallion *et al.* (2009). The theoretical review is to assess nine theorists in line with understanding of poverty. The section will address the various ways of measuring poverty, from the early unidimensional measures of poverty to multidimensional measures of poverty. Approaches that attempt to measure poverty, namely the Monetary Approach (Sen, 1976, Atkinson, 1978, Sen, Shorrock & Thon, 1983; Foster, Greer & Thornbecke, 1984) Laderchi *et al.* (2003)'s social exclusion, Sen (1976)'s Capability Approach, Nussbaum (2000)'s Capability Approach and Participatory Approach by Lardech *et al.* (2003), will be discussed. The main discussion on unidimensional measures of poverty greatly explores the monetary approaches, where ten propositions were propounded by various authors. Five multidimensional measures of poverty are elaborated, where the Alkire and Foster (2011) methodology takes center stage as it forms the crux of the matter on multidimensional measures. Other multidimensional measures elaborated upon are the Bourguignon - Chakravarty (2003), Human Development Report (2020) and the UNDP MPI (2010). The measure of poverty discussion wraps up by elaborating the digitalisation poverty measures being centered on Barrantes' 2007 framework. The focus on these measures was to cultivate a ground for recognizing the Alkire and Foster (2011) methodology and efforts to define poverty in this study.

2.6 THEORETICAL LITERATURE ON DIGITALISATION AND POVERTY

The literature relating to theories on digitalisation/ICT and poverty or economic development are the main focus of this section. The theories to be discussed are Schumpeter's Innovation Theory (1911), Social Exclusion theories (Pocock, 1957), The Culture of Poverty Theory by Lewis (1966), Decision Based Theory by Simon (1978), Dual Labour Markets by Doeringer and Piore (1971), Individual Deficiencies Theory (IDT) by Gans (1995), and The Monetary

Approach by Laderchi *et al.* (2003). The above mentioned theories come from the diverse fields of development economics, psychology and political science. These theories collectively address aspects of technological innovation, social exclusion, poverty, decision-making, labor markets, individual deficiencies, and monetary approaches, which are all interconnected in the context of understanding and addressing social and economic challenges in third world countries such as Zimbabwe. By examining these theories together, researchers and policymakers can gain a more comprehensive understanding of the multifaceted nature of social and economic issues and develop more holistic approaches to addressing them. The idea is to fathom the frameworks that have been propounded before this study, which has taken footage of the current concern on the relationship between digitalisation and multidimensional poverty in Zimbabwe's provinces, and hence address ways of breaking the poverty cycle in this digital age.

2.6.1 Schumpeterian Theory – Schumpeter (1911)

The theory was postulated in 1911 by Joseph Schumpeter. The idea is founded on four major concepts: circular flow, the entrepreneur's role, the end of capitalism, and cyclical processes for business cycles (Englmann, 1994). According to Bodroi and Adler (2018), the foundation of this theory is the idea that changes in investment patterns are closely related to monetary growth. According to the theory, the majority of the rise in investment and business swings in an economy are accounted for by innovation in the business sector (Mehmood et al., 2021), and it is also critical for emerging countries to engage in innovation, technology, and scientific research and development.

Technology can be used by entrepreneurs to expand their operations and hire more staff. Poverty and unemployment rates both decrease when more people are employed (Kiausiene, 2015). As people begin to make money, they are able to raise their level of living by obtaining suitable housing, clean water and sanitary conditions, as well as better access to medical facilities. They pay for the costs associated with the aforementioned necessities out of their wages and salaries. From this vantage point, technical innovation driven by entrepreneurship combats poverty. Empirically, it has been shown that SMEs and entrepreneurs in SSA need to spread technology in order to lower poverty levels (Igwe *et al.*, 2018). This is because higher technology use allows for increased production and business expansion, both of which call for more labor. Since employed individuals have access to housing, wholesome food, water and other necessities, poverty decreases as a result.

However, Schumpeter (1911)'s theory lacks consistence because it tends to rely on social than economic human affairs, such as personal wealth, and that leads to biased conclusions on assessment of the theory of business cycles. As the idea is exclusively dependent on

investment in research and development to fuel innovation and technology, it also leaves out other important factors that cause oscillations in an economy.

In this study, the Schumpeterian Theory is quite valuable since it clarifies some of the characteristics of technological innovation that can be helpful in addressing problems with poverty in Sub-Saharan Africa. According to Schumpeter (1911), innovation can be attained through developing new goods, using new technologies in manufacturing, and expanding one's market and raw material sources (Mehmood *et al*., 2019). The hypothesis is relevant to our research because digitalisation can be a major force behind entrepreneurship-driven economic growth and poverty reduction.

2.6.2 Social Exclusion theories (Pocock, 1957)

According to sociologist and anthropologist David Pocock, all hierarchies have processes of inclusion and exclusion. In general, the debate over inclusion and exclusion contributed to efforts to define what can be referred to as a social ontology, or the manner that the existence and social positioning of groups in a society with a hierarchical structure explains (Pocock, 1957).

Social exclusion involves preventing some members of the society from engaging in economic activity. Disparities in health and neighbourhood conditions, as well as economic and social inequalities, are all examples of how exclusion extends beyond just income. A network based on norms and trust, social capital is a complementary idea to Human Capital theory (Loury, 1977). According to the social exclusion hypothesis, variations in economic success between minority and majority groups result from some people having greater social connections to labour market prospects than others. Rowntree (1901) asserts that the following factors contribute to the minority's inability to attain basic needs, which pushes them into poverty:

- The death of the family's head of home or breadwinner;
- The incapacitating effects of life events on the breadwinner's productivity;
- Consistent job insecurity that lowers income a large family; and
- Poor pay and income.

The challenges of exacerbating poverty due to social exclusion is common in the dependent age groups such as the children, the elderly as well as the disables and minority races. Social exclusion was utilized by Aguayo *et al.* (2016) who used poverty rate, acute resource poverty and family work intensity to measure social exclusion in Spain and Portugal. According to the study's findings, acute poverty amongst those under the age of 16 years has increased in both

countries. Social exclusion in the context of Zimbabwe is applied when some Zimbabwean people gain from a certain policy or program while others, due to circumstances beyond their control, may not be able to gain (Kaseke, 2003). The study, which focused on social exclusion from social security in Zimbabwe, concluded that the majority of individuals were not covered by it. Women were found to be the most excluded in the study. In conclusion, the study found that social isolation has a significant negative influence on the supply of whole human welfare and makes society's marginalised citizens feel dejected and hopeless.

The Social Exclusion theory was applied in later investigations by Munsaka (2014) in the Binga community of Zimbabwe. People with disabilities were the intended respondents. Munsaka (2014:1) concluded that Binga women with disabilities, like their peers, had a strong desire to take part in community development efforts and programs. It was noticed that both men and women with impairments confront insurmountable obstacles to accessing the formal sector, despite their fervor and interest in doing so. The application of sociological theories of poverty in developing nations has not changed much, although Munsaka (2014:1) pointed out that: "*Regarding developing countries, there has been much less interest in whether generous social policies encourage moral hazards. Rather, scholars typically focus on how market inefficiencies and problematic policies disincentivise poor people from investing in productive activities*". Patel-Campillo and García (2022) purported that an obvious path to reducing poverty is to use social inclusion policies which will provide possibilities for a larger social group in a society they dwell in and operate in.

2.6.3 Lewis' (1966) Culture of Poverty theory

Lewis (1966) proposed an anthropological temparament that blamed the government or the poor themselves for behavioral defects such as increased divorce rates, an increase in female-headed single-parent households, teenage pregnancies, alcoholism, drug use, and criminal activity. The theory's crucial component was determining whether generational differences in poverty existed (Lewis, 1966). However, there are misunderstandings and preconceived notions that Lewis (1966) blamed the poor for being poor (Patterson, 2000; Harvey & Reed, 1996:1). Lewis' theory of poverty in fact does not focus on poor-bashing, in line with the Marxist ideological approach, as Harvey and Reed (1996:1) pointed out, but is rather a notion that the poor are trapped in a vicious cycle of poverty, where a low life-style feeds into low savings and low investments and low productivity, leading to low incomes and malnutrition, as show in Figure 2.2.

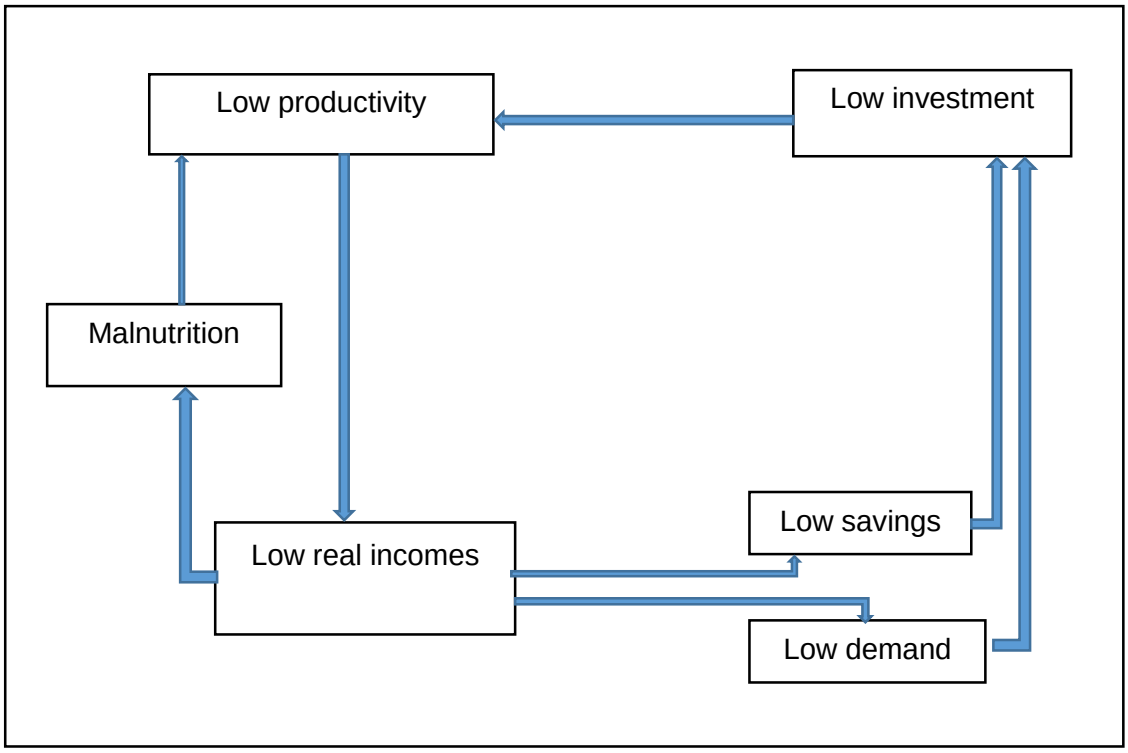

Figure 2.2: The Vicious Circle of Poverty

Source: Lewis (1966)

Poverty has been found to create a way of life, that develops into a culture whereby people learn, share and then socially and economically pass it on to other groups or generations, in the form of characteristics, norms, values and behaviors. As a result, a vicious cycle of poverty id created and adapted by the larger society. People who live in this sub-culture (a little society within a larger economy) isolate themselves from mainstream society, and the miserable lives they lead are passed down from one generation to the next because of children absorbing the group's social customs. It is challenging to break the cycle of poverty that results from this hardship, and children suffer as a result (Unya *et al.*, 2022).

Lewis (1966) noted that people who live in societies where poverty is the norm do not have access to financial inclusion; do not join political parties or labor unions, hospitals, big-box stores, or museums; and as a result, only use services like the army, welfare institutions and the criminal justice system. Their desperation and poverty are maintained by the poverty sub-culture. A sub-culture's members also tend to generate things with minimal market value, which lowers their inclination to riches. They struggle with significant under-employment and unemployment; receive poor pay that is insufficient to cover their costs of living; do not accumulate property; have no savings; and are sometimes forced to pawn their personal goods.

Lewis's work celebrates the resourcefulness and resilience of the underprivileged r,ather than disparaging the lower class and the cultural barriers they have built to protect themselves from the uncertainties of daily life in poverty. Lewis tried to understand the "economic and politically disadvantaged populace whose behavior, values and pathologies are adaptations to their existential position using sociological and anthropological methodologies " (Gans, 1967:116). The disconnection, non-integration and discernment of the deprived people from the major institutions of the economy are the core components of the culture of poverty.

The culture of poverty is related to a culture in the traditional anthropological sense in that "it then designs style for human life and proffers solutions for problems in people's lives, hence it is a significant adaptive function" in addition to being a function of deprivation of human needs, disorganization, or lack (Lewis, 1966). The Culture of Poverty transcends national, regional and international boundaries because it is visible in different societies. It is seen when contrasting rural and urban societies. The theory demonstrates striking similarities in household composition, spending habits, value systems, interpersonal relationships, and family time orientation. The hypothesis emphasizes that ethnic groups' behavior patterns, such as a high prevalence of common law marriages or an increase in homes with a woman as the head, whether at national, regional or global levels, have little bearing on how poverty is perceived by people. This is due to the fact that varied family structures exhibit strong qualities in comparable behavior in the culture of poverty, making factors like female-headed families, slavery, and other explanations for the prevalence of poverty irrelevant.

The poverty approach's value system incorporates data collection methods from sociology, anthropology, and psychology. This includes household employment profiles, income and spending patterns, assets, friendship dynamics—particularly those involving the household's godparent—social support for children, household leisure activities, health and medical histories of family members, political affiliations, religious beliefs, worldviews, residence location, and family size. The theory acknowledges the interconnectedness of both culture and personality (Lu *et al.*, 2022). The preconditions for defining a culture of poverty society have the following features:

- A cash economy anchored on profit.
- Persistently high unemployment rate in the economy.
- High underemployment and extremely low earnings for unskilled labor.
- A lack of political, economic and social organization in the economy, either voluntarily or involuntarily.
- Utilizing a bilateral kinship system to manage economic affairs.
- Existence of nuclear progenitive families as a basis for kinship systems.

- The values of the dominant class influence thrift and wealth accumulation.
- Extreme mobility.
- Personal inferiority and inadequacy of the individual cause poverty or poor income status.

Where all of the aforementioned factors are present, the poor's way of life is primarily influenced by a subculture which is known as the culture of poverty (Vranken, 2019). As people are categorized into poverty classes they become so much more pronounced as individuated in the capitalistic economy, and hence the culture of poverty can be stipulated as an adaptation and reaction cycle of the impoverished. Thus, young people growing up in deprived societies such as slums unconsciously absorb the fundamental attitudes and values of their subculture, and these values become so deeply ingrained in them that they are unwilling to take advantage of any opportunities that may arise from the larger society. Institutions and agencies in larger society have institutionalised local poverty to the point where the poor are ineligible for services because they cannot afford them, are unaware of them, are suspicious of them, are afraid of the unknown, are apathetic, or have established institutions and procedures for subculture economy ways of life (Hercyk, 2020).

Lewis (1966) stipulated that people who live in societies where poverty is the norm do not have access to financial inclusion; do not join to political parties or labor unions, hospitals, big-box stores or museums; and as a result, only use services like the army, welfare institutions, and the criminal justice system. Their desperation and poverty are maintained by the poverty subculture. A subculture's members also tend to generate things with minimal market value, which lowers their inclination to riches (Hercyk, 2020). They struggle with significant underemployment and unemployment, receive poor pay that is insufficient to cover their costs of living, do not accumulate property, have no savings, and are sometimes forced to pawn their personal goods. They borrow money from the informal market, where usurious interest rates are common, and they also frequently use second-hand goods, including clothing, furniture and fixtures. They struggle with a food deficit because they only buy in little quantities, as well as a severe monetary crunch and incarceration. Through transmission, such a vicious cycle leads to inter-generational poverty (IGP), which is then sustained.

Lewis (1966) indicated that people who live in a culture of poverty frequently imagine themselves to be wealthy members of the middle-class, and they frequently favor consensual unions over civil or religious marriages. This allows people living in poverty to freely associate and obtain divorce choices whenever they see suitable. Children are fundamental to this subculture's social structures, with women tending to claim ownership of the children they have. This subculture's members distrust the government and those in high positions have a

deep dislike for the police, and are skeptical about the church and its principles. People in this subculture have strong urges to participate in political activities that challenge the status quo and to have fun doing it. Lewis (1966) asserts that people in a culture of poverty live in sub-standard, overcrowded dwellings, are friendly to one another, but have little to no organisation outside of the family nucleus and the family's extended family. The entire neighborhood is characterized by *gangsterism* and informal groups. Family members dislike childhood because it is seen as a time of confinement rather than protection. Due to space constraints, there is minimal privacy within families, and the extended families of the moms who happen to have the power to rule are preferred. In families with little finances, sibling rivalry is frequently the result, since physical affection is highly valued.

The people who live in slums and are immersed in a culture of poverty frequently exhibit inferiority complexes, helplessness, and a dependent mentality (Lewis, 1966). Additionally, those living in this environment lack a distinct sexual identity, have a weak preference for delaying satisfaction, have a high tolerance for psychiatric dysfunction, and have no concrete plans for the future. Men have a strong sense of superiority, which is manifest in their masculinity. The males, however, are not well-versed in the history of their neighborhood and, what is worse, they are ignorant of the wider world. Despite being status aware, they show a lack of vision. These civilizations tend to be low-tech, yet they constitute a powerfully united force against urban insurrection.

Lewis (1966) asserts that the culture of poverty thrives in capitalism, free enterprise and colonial civilizations, but is primarily created by the absorption of people from lower socioeconomic echelons. Since the economy of Zimbabwe is not a free market, the theory cannot be properly applied in this situation. Although it is challenging to eradicate the culture of poverty, it is suggested that income redistribution, re-organization of the poor, mental care, and addressing the qualities of the culture of poverty will all aid in breaking the poverty cycle.

The theory is mostly applied in the US and the UK as a significant "explanatory tool" for criminology and sociology and to comprehend young aberrant behavior (Blackman, 2014). Although there is no proof that it influences Zimbabwean policy, the hypothesis can help to explain the features of the unofficial economy. The notion of the culture of poverty has drawn criticism primarily for blaming the poor for their circumstances, rather than identifying the root problems that contribute to poverty (Gans, 1967; Mandell & Schram, 2003; Rank, 2004). This argument continues to be a tool employed by politicians to defend social injustice in many settings. The idea was criticised by Davis and Martinez (2014), who called it ‘biased’ in how it interpreted attitudes and common patterns amongst poor individuals and their society. They also came to the conclusion that the research was uncontrolled and person-centered, which

prevented numerous individual values and beliefs from being seen (Davis & Martinez, 2014:21).

This idea falls short of clearly defining and quantifying the differences between the subculture poor and the general poor. The model's application of poverty also exhibits inconsistencies, and the theory's propensity for cultural self-reinforcement falls short of properly capturing the reasons of poverty. According to one perspective (Massey & Denton, 2019), poverty is essentially a function of the fundamental circumstances or social structure in the country under investigation. The claims made by Lewis have been refuted, yet his presumptions regarding the possibility of an unorganized, confused and fatal society are illogical, given that all societies strive for expansion but are frequently constrained by economic constraints. Stack (1974:23) earlier on hinted that the idea of a "culture of poverty" explains why poverty persists in terms of the negative characteristics seen in a society, such as family dysfunction, social disintegration, individual disorganization, resignation, and fatalism. The notion of the "culture of poverty" is predicated on the idea that if poverty-related situations were to change, the poor would be unable to adapt socially. It is therefore presumable that the subculture would be left without a culture or with just entirely detrimental characteristics, as further amplified by Lewis' (1966) view.

The typical interpretation of Lewis' theory of subculture poverty that places the blame on the victim has drawn criticism for being either "designed or accidental" (Valentine, 1968:29; Howe, 1998; Jordan, 2000; Bradshaw, 2007; Ainslie & Altman, 2022). Why not outlaw the subcultures that contribute to poverty since they are so easily identifiable in order to prevent poverty from spreading and degenerating as a tool for social policy? Given that Lewis' theory is perceived as a "pejorative tradition" that primarily targets black families and is connected to the Frazier studies of the Negro families, its application in a society like Zimbabwe has been further questioned (Harvey & Reed, 1996:470).

The Moynihan Report, an empirical study used to support the hypothesis in the 1990s, claimed that poverty is caused by racial discrimination and the incapacity to cultivate virtues like selflessness, rational thought, judgment and knowledge that are essential for success (Jordon, 2000; Bradshaw, 2007). According to Rank (2004), the primary reasons for poverty are economic mismanagement, political incompetence, and social system failings. He claims that emphasizing personal characteristics as the root of poverty is incorrect and misdirected (Rank, 2004:50). In this context, it is necessary to investigate alternative opposing theories of poverty in order to determine its root causes and the best course of action for eradicating it.

Instead of focusing on eliminating poverty, Lewis' proponents about the poverty culture aims to "eradicate a deviant subculture that offends bourgeois sensibilities" in line with what Harvey

and Reed, (1996) argued upon. Lewis' hypothesis had shortfalls which makes it not relied upon much, as forwarded by Valentine (1968:20) who noted that: "*Ultimately, [Lewis] is saying that the alleged culture patterns of the lower class are more important in their lives than the condition of being poor and, consistently, that it is more important for the power holders of society to abolish these lifeways than to do away with poverty - even if eradicating poverty can be done more quickly and easily."*

Lewis' theory, focuses on those third world economies and fails to be categorized objectively as a strategy to fight poverty, has been criticized much by a number of authors who pushed for a lot of revisions to his notions, according to Howe (1998). According to Narayan *et al*. (2009), being poor is not primarily a product of culture because everyone aspires to achieve better in life. As a result, the hypothesis of a culture of poverty cannot account for the problems people have in breaking the cycle of poverty. Indeed, when chances for employment, economic advancement and liberation, or human development are created, poverty will be eradicated.

Dube (2019:58) agrees with Narayan *et al*.'s (2009) assertions that people strive for achievement and engage in a variety of struggles to escape poverty. This theory does not capture these conflicts. Lewis supports the capitalists in their efforts to undermine marginally poor socisties and blames them for causing poverty, which runs counter to the view that eradicating poverty necessitates government policies and programs created specifically for the poor. As a result, applying Lewis' theory is a fruitless endeavor (Valentine 1968:76). In line with Harvey and Reed (1996:471), it looks as if Lewis is a "bourgeois reactionary guilty of the sin of psychological reductionism when it comes to comprehending poverty, its underlying causes, and its basic treatment", which supports the ideas that Lewis has advanced.

Leacock (1971) expressed doubts about the application of Lewis' theory of poverty in a different study. According to Leacock (1971:10), cultural deprivations and low-class culture encourage poverty-related misconceptions. However, certain findings from anthropological and behavioural science studies on concepts such as "lower-class culture," "cultural deprivation," and the popular "culture of poverty" have led to incorrect portrayals of the poor, particularly black poor (Leacock, 1971).The argument from the nineteenth century that the poor are poor because of their own lack of talent and initiative has returned in a new form, well-dressed in scientific language, thanks to the "culture of poverty" and related ideas.

It is questionable whether sub-culture societies even exist. Leacock (1971:11) further counsels the existence of a self-replicating culture of poverty in which instant delight and satisfaction rule. This indicates that there is a political undercurrent that attempts to justify why some

individuals are wealthy while others struggle through life (Harvey & Reed, 1996:472). Politicians no longer need to argue that poverty cannot be eradicated by rising salaries for the lowest paid and the destitute. It is not always simple, according to Stack (1974:23), to boost the incomes of the poor in order to reduce poverty.

According to Rigdon (1988) as well as Harvey and Reed (1996), Lewis' ideas are fraught with many issues in the build up to the research results on culture of poverty. The two authors allege that Lewis altered the data so as to suit the argument which was being advanced. These claims perceive that Lewis tailor made the works so that readers will be influenced by the outcomes in line with what [Lewis] wanted. The message was no longer express as "This is what I have come to understand about how poor people live their lives", but rather "This is what I have seen; don't you see the same things too?"

Lewis's theory has lost ground in recent discussions of poverty because of this flaw (Harvey & Reed, 1996) as academics focus on the numerous issues with the theory's applicability to various social contexts. As scholars and researchers seek beyond Lewis's hypothesis, certain studies (Rigdon, 1988; Harvey & Reed, 1996) that utilized Lewis' technique discovered different results. As a result, Lewis' idea has been marginalized to some extent.

2.6.4 Decision-based Theory by Simon (1978)

According to behavioral theory, no one would work if there was no need for poverty to urge individuals to labour, which is referred to as the "virtue of labour" in line with Davies and Martinez, (2014:18). The perception is that poverty must exist for people to participate in the workforce. According to Bertrand *et al*. (2004) and Durlauf (2011), people in poverty are poor because they engage in non- and counter-productive activities that raise their risk of poverty. This is especially true for those who do not work. According to Kaida (2015), the presence of those who act in such counterproductive ways contributes to poverty. Additionally, it was discovered that poor civilizations are typically culturally diverse, which results in behaviors such as drug misuse, adolescent sexual difficulties, and bad educational practices (Harding, 2010).

Davies and Martinez (2014) highlighted that the economic choices that come from inefficiency are what leads to poverty in most circumstances. However, Sawhill (2003), Kaida (2015) and Cruz and Ahmed (2018) concur that behavior is the main cause of poverty, and poverty rates are high in communities where such behavior is prevalent. In the competitive economy, where continual skills growth is necessary, people may lack dexterity, excellent work ethics, moral judgment, or knowledge. The theory's proponents blame poverty on individual characteristics rather than market forces, and isolate government as playing no part in the cycle of poverty.

Therefore, poverty is a decision made when people's shortcomings, personal efforts and capacities conflict with the market forces in effect at any given time (Townsend, 1979). Helping the impoverished is not necessary, according to the theory's proponents.

However, making philanthropic contributions to recognised organisations is the most effective way to assist the underprivileged. With little to no political or societal influence, people actively influence their productive outcomes. As a result of their decisions, they are more likely to fall into poverty (Blank, 2010). Subsidies, according to proponents, should be eliminated as a measure to combat filth and poverty. Kasarda and Ting (1996) recommend employing modest social transfer measures to relieve poverty or escape the poverty trap when people lack incentive to work. Blank (2010), on the other hand, is a major proponent of time-limited financial aid tied to employment requirements and support for the establishment of anti-poverty programmes, rather than simply providing aid.

Theoretically, providing subsidies to combat poverty will demoralise other people who are prepared to work, according to behavioural poverty proponents(Pavetti, 2016). This was indicated by Pavetti (2016) by indicating that receiving government benefits, in America, has somewhat deepened poverty, as reciepients sink into the dependence syndrome. Poverty is a function of personal choice, people who were previously not poor would now label themselves as poor only to be free-riders in government aid schemes and they withdraw their labor as a result. Since people choose to live in poverty, those who were previously not poor will now declare themselves to be such in order to take advantage of free benefits and welfare transfers (Pavetti, 2016). As a result, they withhold their labor.

Between 1979 and 2001, the UK used the behavioral theory to increase incentives for lone mothers. The increase was brought on by a rise in unemployment amongst this population. Nevertheless, the US saw contrasting results during the same time period. The US's unfavorable response to the notion was that people's employment benefits from working out were greater than the increases in societal benefits (Davies & Martinez, 2014).

The sole proof that behavioural poverty is being used in Zimbabwe comes from a study by Kamoyo and Makochekanwa (2018), who looked at the effects of poverty, risk-aversion behavior, time preferences, and maize marketing preferences in the Mashonaland West province's Zvimba and Makonde districts. A total of 433 maize growers from the two regions were included in the study. The study found that farmers' market timing and risk-aversion attitudes were crucial behavioral factors in preventing farmer poverty.

Theoretical formulations of behavioral theories continue to have little practical relevance (Brady, 2018:9). It is also criticized for disregarding market failure, which is a concept from the

Neoclassical Theory, in the policy framework for behavioral theory. Additionally, Keynesian theory and Marxist theory both highlight how the collapse in aggregate demand can cause unemployment and joblessness. Behavioural theories have drawn criticism for their ambiguous claims about the etiology of poverty and for the lack of a clear explanation for the causal order they establish (Streib *et al*. 2016).

The association between behavior and poverty has also been highlighted to be inconsistent in line with Rothwell and McEwen (2017). For example, the majority of the work on behavioural poverty focuses on single mothers (Brady, 2018:9). In contrast, according to Brady (2018:9) and the results of a different study by Bloome (2017), "*single motherhood is not even statistically connected with poverty in 19 out of the 29 prosperous democracies*". Thus, one may foresee that "single motherhood is not even significantly related with poverty in 19 out of the 29 prosperous democracies" (Brady, 2018:9), and a subsequent study by Bloome (2017) also came to the same conclusion. Additionally, behaviorists have failed to explain macro level poverty (Heuveline & Weinshenker, 2008; Brady, 2018:9–10) since cross-national inequalities in poverty cannot be explained by the inter-national incidence of poverty (Brady *et al*., 2017; Brady, 2018). Further research is required to determine the applicability and explanatory strength of behavioral poverty theories in light of this disparity (Brady, 2018:11).

2.6.5 Dual Labour Markets by Doeringer and Piore (1971)

Doeringer and Piore (1971) first put forth the theory of Dual Labour Markets which purported that the labor market is divided into primary and secondary sectors, each of which has unique characteristics regarding labour and production. Townsend (1979) highlighted that the Marxists lay more emphasis on the secondary sector since it provides insecure employment, a homogenous labor force performing uniform duties and offered no needed for job training. Secondary sector employees may face poverty in the form of poor pay and few opportunities for advancement, compared to individuals hired in the primary labour market. By establishing trade unions that then establish minimum standards in secondary workplaces, poverty can be addressed in the industry. In order for the secondary labour force to integrate into the workforce, trade unions can also negotiate for mandatory on-the-job training.

The uncontrolled informal sector makes up the majority of Zimbabwe's secondary labor market which makes Doeringer and Piore (1971)’s theory to relate very well to this study. Even though the government claims that there are more jobs in the unorganized sector, because there are poor wages, little job security and no pension prospects, those who work in this sector are more likely to live in poverty. The Dual Labor Market theory's segregation may apply to the Zimbabwean context being investigated. Aspects such as gender and religion may not be much pronounced, but the components of primary sector is much more pronounced with a

mixture of blue and white collar professionals while the secondary and tertiary sectors is made up of the uneducated and marginalized elements of the society.

2.6.6 Capability Approach by Sen (1976)

Sen's (1976) functioning and capability axiomatic approach was propounded by Amartya Kumar Sen, an Indian writer who had outstanding works in the field of Human Development. Due to the theoretical constructs which were insensitive to the allocation of income amongst the poor, Sen (1976) criticized the monetary poverty measures. He offered an axiomatic viewpoint that poverty is a state of capability deficiency. The Capability Approach instead looks at the freedom to live a valued life as a substitute for utilitarianism of monetary income as a gauge of wellbeing. Furthermore, the capacities approach regards life as a collection of doings and beings known as functionings, and they link the assessment of the quality of life to the assessment of the capability to function, as proposed by Sen (1993). Sen (1976) defines poverty as deprivation or failure to satisfy society's least requirements, which reduces mortality and morbidity. Deprivation includes a lack of basic abilities such as being adequately fed or having the freedom to engage in regular motions, having self-confidence and self-respect, and fully participating in social endeavours (Sen, 1993; Laderchi et al. 2003).

The theory of capabilities approach defines wellbeing as personal freedom where the capacity of individuals is to tolerate physical and economic neglect (Laderchi *et al.* 2003). Sen (1999) agrees that a person's capability deprivation can be primarily caused by a lack of income, which is also a significant risk factor for living in poverty. The capacities perspective reveals a number of ways in which human existence is harmed, in line with Hick (2012). The approach focuses more on what people can do than on what they have or how they feel. Sen (2009) suggests that instead of focusing primarily on means of life like money and expenses, the analysis of poverty and wellbeing should instead focus on the real chances an individual has. According to Hick (2012), functionings are constitutive of a person's being, and an evaluation of a person's well-being has to take the form of an assessment of the component aspects which include the emphasis of being on genuine or substantive freedoms, as opposed to formal freedoms (Sen, 1993).

The capabilities approach is a different way of assessing poverty that abstracts human behavior, assesses wellbeing, and establishes policy goals based on the behavioral tenets of non-utilitarianism and utility maximization. Financial considerations are only considered as a tool to improve wellbeing rather than as a desirable result (Sen, 1993; Laderchi *et al*. 2003). The different tasks that a person completes while doing or being in, such as community involvement, are referred to as functionings. On the other hand, capacities specify the

essential liberties persons require to achieve functionings, such as the capacity to engage in daily activities in society (Sen, 1999).

In contrast to conceptual analysis, Hick (2012) contends that the choice of functionings and capacities is a component of the informational space of among other capabilities, poverty analysis in the framework of the normative focus of poverty and justice. According to Sen (1995), the capacities range from more basic social factors like self-assurance in one's appearance and community involvement to more complex physical life features like having enough food, shelter, clothing, and morbidity-free time. The capabilities approach is shown in Figure 2.3 below, in line with Sen (1976). It is obvious that different scholars agree on what should be included in capabilities approach fundamental capabilities and measurement.

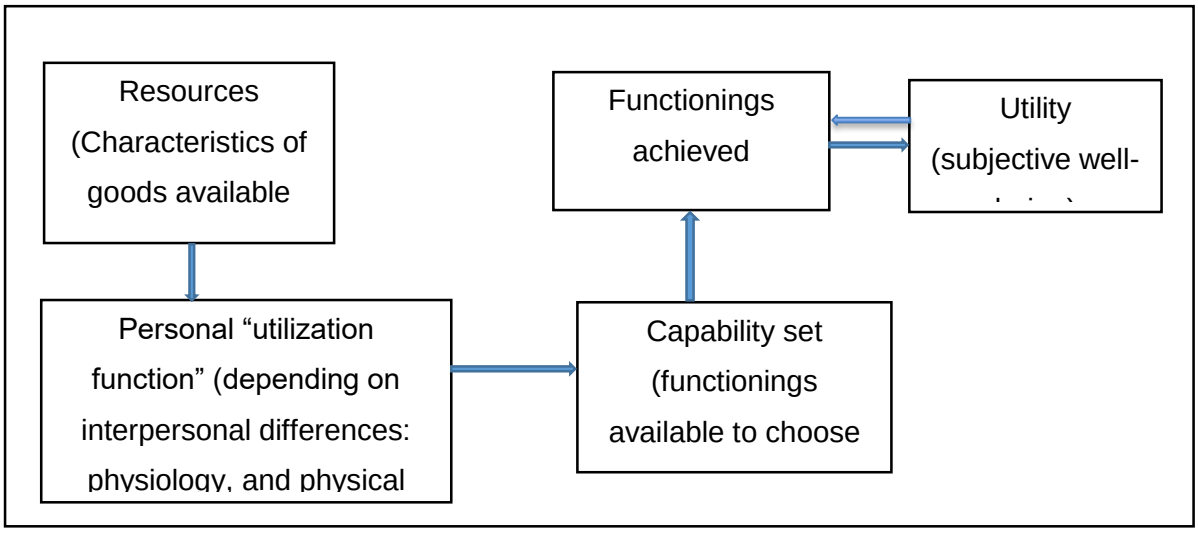

Figure 2.3: Capabilities Approach

Source: Sen (1976)

The fundamental connections between the capability approach and the primary competing approaches are that it emphasises resources and utility as shown in Figure 2.3. Assets such as a bicycle are regarded as inputs whose contribution to poverty alleviation emanates from a functioning such as riding, which in turn depends on health, physical environment such as pathways, norms etcetera. In line with Sen (1976), the collection of these functionings is what is coined as capabilities, and these capabilities should inhibit a bidirectional relation with utility.

Sen (1976) questioned the use of the income poverty approach to quantify poverty because it ignores the fact that income is a contingent variable as well as a means to possibilities that have inherent value to people (Sen, 2009:233). Sen found that people have varied demands and need different levels of resources to reach equal standards of living. He did this by converting resources (means) into capabilities (Hick, 2012). With a given set of resources, the

capabilities approach prioritizes the intrinsic values of what people can accomplish or be. The idea is "unambiguously in favor of a direct approach to poverty analysis" (Hick, 2012).

Capabilities approaches offers a clear technique for defining poverty in the perspective of people's quality of life and freedoms. This strategy, which takes the shape of social commodities, is more multifaceted than the monetary strategy. Additionally, the capabilities approach offers flexibility in measuring poverty. It provides situational poverty measurement, which is crucial for poverty study as agreed by Laderchi *et al*. (2003) and Schokkaert and Van Ootegem (1990) who used the capacities method for Belgium and came to the conclusion that a wider range of factors than material well-being was more important in determining poverty than material features.

Another study was successfully conducted by Slottje (1991) to create a quality of life index utilizing 126 nations and 20 indicators taken from the Capability Approach theory. There is no concrete proof that the Capability Approach has been used to estimate poverty in Zimbabwe. Though it reflects accomplishments at the level of society and the usage of the poverty line is still controversial, Capabilities Approach to a greater extent demonstrates the individualistic approach of the financial method as capabilities are attributes of the individuals. These are imposed without any theoretical foundation for how to do so. Sen (1976) emphasized the following key benefits of the theory, as itemised by Mowafi *et al.* (2004):

- The Capabilities Approach emphasises innate poverty and other forms of hardship outside of money.
- There are many factors that affect capability deprivation besides income poverty.
- The relationship between poor income and low capability differs among communities, families, and people.

Other theories of poverty lack the multidimensional perspective that the Capabilities Approach provides as purported by Atkinson *et al*., (2002: 79). Hick, (2012) stipulated that Capabilities Approach implies that it resolves the contradiction between restricted and expansive approaches to poverty by honouring the earlier while keeping the subsequent in mind.

According to Lister (2004), the classification of impoverishment in terms of failing to meet capability actually conflates poverty with a much broader concept such as quality of life or well-being due to a lack of resources. According to Nolan and Whelan (1996) and Volkert (2006), the Capabilities Approach connects poverty and resources because some of society's most vulnerable members, such as voluntarily homeless people, drug and alcohol addicts, functional illiterates, and those who have experienced physical or mental abuse, face circumstances that are not immediately due to a lack of resources. Hick (2012) maintained

that the capabilities approach stresses imposed deprivation rather than voluntary non-participation, and that this is not readily available in most poverty measurement theories.

According to Mowafi (2011), Sen's (1976) key problem in the Capabilities Approach is that it does not specify whether the immediate aim is perfect equality. As a result, Nussbaum (2006) established that the most pressing goal is to get the poor to a place where they no longer need to be assisted. When everyone has passed the threshold, it is advised that there be expectations about what we must accomplish. Furthermore, Nussbaum (2006) contends that Sen's views do not take a stand on what

Lister (2004) criticised Sen's capacity approach, claiming that it differs from a poverty approach in that not all capability deprivation is due to a lack of resources and hence would not generally be considered a case of poverty. Furthermore, conceptualising poverty is not the same as defining poverty in terms of capability. What matters is a major topic addressed by the capabilities approach. The capabilities approach to poverty is an ethical matter, but the poverty question is a powerful conceptual question. The differences between these questions provide insight into the relationship between the ability and comprehension of poverty (Hick, 2012). Additionally, the Capability Approach methodology is skewed because it only considers what people can do with their lives, not how they feel about them or what they own (Hick, 2012).

The Capability Approach differs from earlier research such as Nolan and Whelan (2011) who established what should be avoided by people if possible, and Townsend (1970) who determined ethical appeal to human needs. But human demands and problems, which we would all like to avoid, necessarily encompass both monetary and non-monetary elements, necessitating the adoption of a framework that can take both into account (Hick, 2012). To make matters worse, Capabilities Approach does not consider other obstacles that prevent participation, such as disability or prejudice, and while these are conceptually distinct from a lack of money, they cannot be considered as being of no relevance, (Hick, 2012).

Walker and Unterhalter (2007) adds his voice to the list of those who have criticized the Capabilities Approach for measuring poverty, saying that there is a genuine justification for a list, but this should be for specific objectives, or evaluation, or critique. It shouldn't be rigid or canonical, it shouldn't be arranged in a hierarchy, and it should incorporate participation and debate in some form (Walker, 2006)

2.6.7 Individual deficiencies theory (IDT) by Gans (1995)

According to Gans (1995), the individual deficiencies theory comprised of a wide array of justifications which are placed upon individual state of poverty. Traditional political theorists

have been claiming that sometimes people in the poverty bracket are there because of their own fault because they could have made better choices to avoid frequently claim that people in poverty are at fault for their own difficulties and contend that with more effort and wiser decisions, the poor could have avoided (and can now cure) their issues. In other ways, personal traits such as intelligence that are hard to come by are also inculcated in Gans (1995) as contributory to being poor or non-poor.

It's a long-held misconception that poverty results from personal shortcomings. The Protestant Reformation's core religious ideology, which connected riches with God's favour (Weber *et al.,* 2001), stipulated that individuals who were physically challenged such as being paralyzed, blind, or otherwise physically deformed were chastised by God for either their own crimes or the sins of their paternities. When the concept of inherited intelligence first developed in the nineteenth century, the eugenics movement went so far as to justify impoverishment and even sterilisation of individuals who appeared to have limited capacities. A recent study that employs this explanation is The Bell Curve by Herrnstein and Murray (1994).

Critical analysis of individualistic views of poverty is provided by Rainwater (1970:16) *"The poor are afflicted with the mark of Cain; they are supposed to suffer, indeed must suffer, because of their moral shortcomings,"* according to this moralizing perspective. On earth, they reside in a justifiable hell.

The extent to which the perspective above supports the perceptions of poverty, including the perspective of the disinherited themselves, cannot be overstated, as purported by Rainwater (1970). The fundamental tenet of this prevailing paradigm for the study of the factors that cause poverty is that people make decisions and investments with the intention of maximizing their own well-being (presuming they have perfect information). Economic theory holds the person generally accountable for their own decisions when some people opt for short-term and poor pay-off returns, such as skipping college or other training that will result in better-paying positions in the future. In publications that attribute the persistence of poverty to the generous welfare system, the economic idea that the poor lack motivation to improve their circumstances recurs.

Gwartney and McCaleb (1985:7) argue that, despite historic increases in welfare spending, poverty among working-age adults increased during the war on poverty (adjusted for non-cash transfers). They conclude that "the application of simple economic theory" points to the war on poverty measures as the source of the problem:

> "*They [welfare programs] have introduced a perverse incentive structure, one that penalizes self-improvement and protects individuals against the consequences of their own bad choices.*"

The Horatio Alger myth, which says that anybody is capable of achievement with hard work and skill, and that drive and perseverance are the sole conditions for success, is a less criticised American form of the individualistic theory of poverty (Asen, 2002). Bradshaw (2007) tells how he was given a list of self-improvement targets to focus on and finally became a number of the mostly wealthy and well-paid salespeople in America. He goes on to argue that everyone can succeed with a simple formula of hard work and focused goals.

2.6.8 The monetary approach by Laderchi *et al.* (2003)

Laderchi *et al*. (2003) developed the idea using the poverty income technique. According to this monetary definition, consumption from a person's or a household's current income determines how poor they are. Marginal productivity affects the amount of money available for spending. A rise in productivity raises the amount of money that laborers make.

Since the 17th century, monetary theories have predominated discussions of poverty as highlighted by Sumner (2007), and a World Bank report by Roelen (2017). The monetary approach's proponents demonstrate that households have the same tastes and wants and are entirely individualistic and utility-oriented in their behavior and attitude (Davies & Martinez, 2014).

According to the notion, government should raise GDP levels, which would directly raise wages and also directly raise work opportunities for the poor. As the poor's employment and pay growth boosts their income, the vicious cycle strengthens macroeconomic benefits across the entire economy. As a result, the impoverished can afford the needs of life, which among other things improves their health. This idea contends that the government's efforts to eradicate poverty must consider consumption while analyzing poverty. Additionally, income is crucial to reducing poverty since it enables poor households and individuals the purchasing power to confront inequity in society, according to Lakner *et al.* (2022). The impoverished would therefore benefit from having access to public goods as a result of state income.

By assigning monetary value to non-market products and services, the monetary method is likewise applied to those. The overall consumption of a person is determined by their household's income or expenditures. People are poor if their income or spending is below the minimum criterion. The World Bank adheres to this definition of poverty as the primary one. The financial approach divides people into primary poverty if they fall below the normal poverty level and secondary poverty if they get over it in line with Omar and Inaba (2020).

The monetary approach by Laderchi *et al*. (2003) relates quiet well to how Zimbabwe's poverty measurements have been explained. Financial poverty is measured by the ZIMSTAT ICES of 1995, ICES of 2001, PICES of 2011–2012, PICES of 2017, and PICES of 2021 (ZIMSTAT, 2021). ZIMSTAT (2021) measured and compared rural and urban poverty using the ICES and PICES. The primary factors used were productive assets, revenue sources, and employment types (ZIMSTAT, 2021). According to a ZIMSTAT (2020) on financial poverty, (42.5%) of national households had low incomes, and those having a member who worked in the formal economy were (20%) less impoverished than those without such a member.

The monetary method has come under fire since not all significant facets of human life are included in the definition of poverty. Since poverty has many different dimensions, it is important to take into account non-financial indices and circumstances. This continues to be the one area where income poverty falls short. Furthermore, the theory ignores the variety of households, individuals, and their contextual circumstances by assuming uniformity in financial measurements (Davis & Martinez, 2014).

The method also ignores shocks that people experience over time, like as recessions, layoffs, divorce, illness, childbirth, and changes in aggregate demand or supply that impact people's patterns of income and spending over time. This monetary method essentially ignores assets that can define poverty and inequality, such as debt incurred, wealth and savings amassed by people and households, price fluctuations that occur in various geographic places, and other significant elements. The approach ignores the importance of government-provided social services (public goods) and development partners' (donor aid) roles in promoting wellbeing.

The regularity with which nutritional demands are addressed is the theory's further flaw. People are not all created equal, and as a result, they have varying metabolic rates, lifestyles, and gender preferences. It has been argued that the theory data is skewed in how it defines poverty because it concentrates on individuals who gather data at the level of income. Finally, the theory employs value judgments that are then exogenously applied without the poor themselves being directly involved in the development and use of the model.

2.6.9 Theories on Perceptions of Poverty by Feagin (1972)

In line with Feagin (1972), the three main perspectives on poverty are individualistic, structural, and fatalistic. Individualistic perspectives hold that poverty should only be attributed to the poor people themselves, while structural beliefs hold that poverty is a result of external social, economic, political, cultural, or societal factors (Smith & Stone, 1989, Sun, 2001 & Shek, 2004). There is very scant evidence of studies on how people in Zimbabwe perceive poverty.

Understanding how people and society view poverty is essential for developing effective poverty policies.

Using a questionnaire, Nasser *et al*. (2002) evaluated participants' perceptions of poverty during the years 1998 and 1999 from three different countries: South Africa (n=192), Lebanon (n=251), and Portugal (n=120). The goal of the study was to identify the individualistic, structuralist, and fatalistic roots of poverty. A stepwise regression analysis was employed to quantify the sense of poverty, and the research response rate was (96%). The research came to the same conclusions as Feagin (1972), namely that structuralist poverty was the primary culprit, followed by fatalistic and individualistic theories, in that order. The study did, however, discover conflicting findings in regard to schooling. Children with uneducated moms had the lowest individual perception of poverty in Portuguese, whereas it was the opposite and neutral for Lebanese in South Africa. The true relationships between poverty and education.

Ambuyes (2012) used data from the Ethiopian Rural Households Surveys (ERHS), which collected information on poverty from households in 15 villages between 1989 and 2009, to determine how people perceived poverty in rural Ethiopia. The study attempted to determine whether poverty was indeed declining as their government had declared. The outcomes were contradictory, as several factors—such as health, credit, and housing—improved while consumption and wealth fell. When asked how they felt about happiness, respondents indicated that they were (60%) pleased, (23%) not very happy, and (17%) very happy. From earlier research by Dolan *et al.* (2008) and Clark *et al*. (1981), which both came to the conclusion that happiness was dependent on income, socioeconomic, environmental, and personal factors, it was assumed that happiness was a proxy for healthiness.

The results do not agree with those of previous research. Dercon and Gautam (2011) discovered that poverty had actually increased over that time. In addition, the researchers admitted that they had selected a tiny sample that wasn't representative of the nation. Delavega (2016) conducted study on how US social work students perceive poverty. The study's nonprobability convenience sampling technique was used to choose social work students for the academic years 2013–2014 in an effort to create a blame index. Participants in the study came from a wide range of social, economic, racial, and cultural backgrounds, and the sample size used was 233. Survey Monkey, a cloud-based and online data collecting and sampling tool, was employed in the study. On the surveys, the five perceptions of poverty scale by Castillo and Becerra, (2012) was applied, which included perceptions of structural, governmental, and social welfare advantages.

Additionally, they used demographics and residential area (rural or urban). Data analysis was done using the Statistical Package for the Social Sciences (SPSS), and multi-collinearity was

determined using Pearson r correlation. The demographic and personal information of the respondents was also established using ANOVA and t statistic tests. The findings showed a reduced personal impression of poverty and a higher structural perspective. However, the study acknowledged that several of the factors, such as race, violated homoscedasticity and that disagreements between whites and blacks' opinions were unimportant to the study. According to Hunt (2004), black people are more susceptible to poverty than white people.

Maseko and Viljoen (2013) investigated the perceptions of poverty in post-apartheid South Africa. The information was gathered from a university in South Africa's Southern Gauteng Province. To find participants, a convenient non-probability sampling method was applied. After obtaining the concerned lecturers' agreement, the questionnaires were distributed to students in their lectures. The individualistic, structural, and fatalistic conceptions of poverty's causes are important predictor variables for the study, as mentioned. Statements 1 through 5 pertain to the fatalistic reasons of poverty, statements 6 through 9 to the structural causes, and statements 10 through 12 to the individualistic factors. With the use of Varimax rotation and Principal Component Extraction, a confirmatory factor analysis was carried out. Analysis of reliability was also done, and the results of the analysis confirm those found by Feagin (1972), Sun (2001), Davids (2010) and Grobler and Dunga (2016). However, there have been numerous empirical studies on poverty perceptions, but none have focused on the concept of digital poverty. In an effort to strengthen the understanding of digital poverty, this study aims to investigate the relationship between digitalisation and poverty dimensions in Zimbabwe.

2.7 THEORIES ON MEASURES OF POVERTY

A measure of poverty is an index that compiles all data on the underprivileged people (Bibi, 2005:1, Ravallion, 2020). Measures of poverty are frequently used to track socioeconomic conditions and to set benchmarks for success or failure. The findings of the measurements will be used by policymakers to create and build policy implications and programs to combat poverty, while the effects of external factors (such as runaway inflation or the implementation of a government transfer program) can be considered.

Nurliyana *et al.* (2017) coined that poverty requires to be appropriately and correctly measured so as to provide meaningful insights to solutions as well as to correctly advise government policy makers. It has to be noted that the poverty measurements such as framework for poverty analysis, must seek to reflect societal changes and economic shocks in the event of paradigm technological shifts such as in fourth industrial revolution, or pandemics such as COVID-19 emerge. That is to say, the right poverty measurement, frameworks and concepts must be harnessed which can address any peculiar situation obtaining, going beyond the twenty first century, (Hick, 2012:1)

According to Xu and Osberg (2002), several poverty indicators and related indices are rarely employed because they are difficult to understand for policy making or by the general public. Some poverty estimates do not adequately depict actual poverty since they are predominantly income driven in their approach to poverty study and assessment (Boonyabancha & Mitlin, 2012).

Statistics on poverty are crucial for describing the complicated socioeconomic conditions that underpin discussions on societal and economic goals. Effective interventions must therefore consider the most important features of poverty. A multidimensional method or a unidimensional indicator (income/consumption) might be used to indicate poverty (such as living standards, health conditions and education).

Poverty measurement is a multifaceted process that comprises two essential elements as outlined by Sen (1976:219). The first step involves identifying individuals who are considered poor. The second aspect involves aggregating the various features of these individuals into a poverty measure. This process requires careful consideration of various indicators of poverty, such as income levels, access to education, healthcare, and basic necessities like food and shelter. Only by accurately identifying and measuring poverty can it be possible to effectively address and combat this complex issue.

Measuring poverty is crucial for gaining insight into the causes and impact of poverty, as well as setting targets for policy interventions. According to the World Bank (2001:16), there are five key reasons to measure poverty: it enables testing of hypotheses on the causes of poverty and the likely impact of policy interventions on individuals, households, and society; provides a comprehensive view of poverty trends over time; allows governments to set measurable targets for reducing poverty; facilitates inferences on the circumstances and evolution of poverty at national and international levels; and permits investigation of connections between different dimensions of poverty.

The reason and worthiness of correctly measuring poverty, is emphasized by OPHI and UNDP (2019) who pointed out that societies and economies ought to develop local MPIs so as to determine comparisons, track poverty, monitor the trend as well as develop appropriate policy measures and strategies to harness this perilous thing. The underestimation of poverty due to poor measurements results in low prioritisation of the appropriate measures required to address poverty..

Furthermore, Haan (1997) claims that quantifying poverty allows for the investigation of sectoral poverty growth trends as well as the identification of the effects of poverty policy initiatives. According to Xu and Osberg (2002:2), poverty measurement aids in determining

the amount of poverty, hence "how much poverty is there" and if "poverty is increasing or decreasing." Most studies now agree that urban poverty is undercounted due of the intrinsic undercounting of populations in an economic domain. This is attributable to data gathering instruments and procedures that have been stationary for many years and have grown outmoded to the task at hand (Mitlin & Satterthwaite, 2013). poverty in development agendas. (Haan, 1997). Although poverty may seem like a straightforward idea, it is challenging to define and quantify, particularly when assessing changes in poverty levels over an extended period (Metzler, 2014:1; Laderchi *et al.*, 2003:244). Poverty measurements differ from country to country as some use relative deprivation (developed countries) whilst other countries use absolute poverty lines (developing countries) (Dotter & Klasen, 2014:3). The various methods used to measure poverty ultimately impact poverty statistics, resulting in different outcomes depending on the approach taken. To provide a comprehensive understanding of poverty measurement, the following subsection will cover both unidimensional and multidimensional measures of poverty.

2.7.1 Theories on unidimensional poverty measurements

This section covers the various methods used to measure poverty, including both unidimensional and multidimensional approaches. Specifically, the unidimensional methods that will be discussed include the monetary approach, social exclusion, participatory approach, and capability approach. Alkire (2009:6) highlights the limitations of unidimensional poverty measurement, stating that this approach only considers deprivations that affect the aggregate indicator, with minimal scope for valuing deprivations in multiple dimensions independently of one another. The four poverty measurement methods that will be discussed in this section include the monetary approach, which focuses on income and expenditure as indicators of poverty; the social exclusion (SE) approach, which considers social factors that exclude individuals from participating in society; the participatory approach (PA), which involves consulting individuals experiencing poverty to identify relevant indicators and measures; and the capability approach (CA), which considers the ability of individuals to function and achieve their goals.

2.7.1.1.0 Monetary approaches of measuring poverty

The monetary approach is the most commonly used method to measure poverty, defining poverty as a lack of sufficient income or expenditure. Researchers such as Martinez (2020), Alimi and Okunade (2020), Wang et al (2016), Saunders et al (2022), and others have employed the monetary approach to investigate various poverty phenomena. Laderchi et al.

(2003) noted that poverty measurement was the first scientific study to classify people into primary poverty or secondary poverty, establishing the existence of the phenomenon.

This section will focus on various monetary approaches used to measure poverty, including the head count, poverty gap index, and poverty severity index. These measures provide a comprehensive understanding of poverty levels and the extent to which individuals or households fall below the poverty line. The section will cover a variety of unidimensional monetary approaches to measuring poverty.

2.7.1.1.1Sen's head count

Sen (2009) stipulated that the headcount ratio is mostly calculated as a percentage of the population living below the national poverty line(s). Head count is the commonest measure explicitly used in quantitative poverty measurements and most researches on Zimbabwe such as Manjengwa *et al* (2012), Zimbabwe UNICEF (2016), Stoeffler *et al* (2016), Berenger (2019), Diaz-Bonilla and Sabatino (2022) etcetera have utilised it as the poverty measure. The basic model from earlier poverty measurement can be shown as:

$H = q/n$……(2.1)

where:

q refers to the total number of the poor people and n stands for the total population size. The poverty measurement was later modified by Atkinson in 1987 to include a ranking aspect of the poor people as shown below.

2.7.1.1.2 Atkinson head count

Atkinson (1987) noted that this technique uses the magnitude of people falling below an arbitrary but intelligible poverty line Z*, which varies between [Z^-, Z^+]. The approach investigates and ranks all of the Z variables in the [Z^-, Z^+] range. The head count then develops a cumulative distribution of Z* for the function F(Y) where Y is income or a measure of the standard of living.

Formally:

$P_0 = \frac{N_p}{N}$…… (2.2)

Np is the number of poor people.

P_0 is the poor population of the community.

N is the population of the community. The aforementioned equation (2.1) can be expressed to display spending, income, and z values as follows:

$$P_0=\frac{1}{N}\sum_{i=1}^{N} I(yi < Z) \quad \text{..... (2.3)}$$

z represents the demarcated poverty line.

yi stands for the expenditure.

N stands for the population size of the society.

The function $I(yi < z)$ takes the value of 1 if the $yi < z$ is true and individuals are counted as poor, otherwise it takes 0 value.

Berenger (2019) postulated that the head count technique is not complex, and is crafted for poverty incidences, which can be suitably be utilized in the context of Zimbabwe, as agreeable with ZIMSTAT and World Bank poverty measurements. In Zimbabwe, the 2012 and 2017 and 2021 ZIMSTAT poverty surveys utilized the head count to measure poverty. The main challenge of this measure is that it fails to express poverty intensity and poverty gaps which will be existing in a certain society (Manjengwa *et al*, 2012). Poverty intensity is important in understanding the inequalities existing between households, for example arbitrary expenditures between two societies as shown below in Table 2.1.

Table 2.1: Arbitrary expenditures between two societies

Expenditures	**Individual expenditures at poverty line of $125**				**Head count (P_0)**
Society 1	100	115	160	170	50%
Society 2	123	124	180	190	50%

Source: Researcher's own Calculation (2023)

According to Table 2.1, both societies are in a situation where (50%) of their population regarded as poor, but society 1 is poorer than society 2 because its total expenditures are lower, a difference that the head count approach ignores. Therefore, using the headcount to measure poverty is inadequate and inaccurate. The head count is also not multidimensional since it focuses on income-related issues and, in doing so, violates the transfer principle, which states that transfers from richer to poorer countries increase welfare measures (Dalton, 2020). The number of persons does not reflect the level of poverty (how poor are the poor), nor does it reflect what happens to those whose circumstances worsen or improve but keep them below the poverty line.

The head count also presupposes that households in the same society have the same welfare and poverty, which is unrealistic in the actual world because welfare varies according to gender, age, productivity, and economic structural changes. However, the analysis can be utilised to give poverty head count statistics that can be used as a poverty datum in accordance with ZIMSTAT (2020). According to ZIMSTAT (2020), between 2011 and 2017, the proportion of individuals living in extreme poverty using the national extreme poverty limit of US$ 1.8 per day rising from (23%) to (30%). It then increased further to (38%) in April/May 2019, with urban poverty rising faster in relative terms (from 4% to 10%) than rural poverty (43%) to (51%). The April/May 2019 head count ratio of people below a US$1.80 per day indicates that the rural folks are poorer than their urban counterparts, of which Zimbabwe has more people living in the rural than in the urban (ZIMSTAT, 2020).

2.7.1.1.3 Poverty gap index

The United Nations (2008) basically defines the poverty gap index as a development above the poverty measure head count ratio, which simply counts all people in a particular population who are below a poverty level and considers them all poor. The Poverty Gap Index calculates the degree of poverty by examining how far the poor are, on average, from the poverty line.

This index calculates how many persons or households fall below the created poverty line as a percentage of the poverty line. As an example, consider the following:

$G_i=(z-yi).\ I(yi<z)$ …… (2.4)

where:

G_i is the poverty gap.

z is the poverty line.

yi is the available income of the poor.

The poverty gap index can be shown as:

$P_i=\frac{1}{N}\sum_{i=1}^{N}\frac{Gi}{z}$ ……..… (2.5)

P_i stands for the poverty gap index.

The mathematical illustration of the poverty gap index is shown below in Table 2.2:

Table 2.2: Poverty Gap Index Illustration

Arbitrary poverty line for the society pegged at $200	Pi
Households' consumption in Society A	

Society A consumption	170	150	165	210	
Poverty Gap	30	50	35	0	
G/z	0.15	0.25	0.175	0	(0.575/4) = 14%

Source: Researcher's own Calculation (2023)

Table 2.2 shows that the poverty gap index is 0.14, and it indicates the poverty gap existing amongst the poor in Society A. This poverty gap index of 0.14 represents a modest gap in which most incomes or expenditures are close to or above the poverty line, implying that poverty is not as severe as it would be if the poverty gap was 0.50. A wider poverty gap index indicates more poverty. According to Manjengwa *et al*. (2016), the advantage of the poverty gap index method is that it captures the resource transfer effect on poverty, it shows how poor are the poor, and it also provides the magnitude of inequality because information from all households is aggregated to calculate society's poverty gap index. However, because the poverty gap is a monetary measure, it does not take into account other facets of poverty such as human freedoms, social determinants, and empowerment, among others. The

2.7.1.1.4 Poverty severity index

According to Salehi et al (2019), this measure is the squared poverty gap, which determines poverty inequality among people in a given society. It is built from total weighted poverty individual poverty gaps. Individuals who are poor are given extra weight in the poverty severity index. Table 2.3 explains how poverty severity is computed using expenditure and the poverty gap.

Table 2.3: Poverty Severity Index Illustration

Assuming an arbitrary poverty line of $200					$(\boldsymbol{P_i})\mathbf{2}$
	Individuals' expenditure in country A				
Country A expenditure	170	150	165	210	
Poverty gap	30	50	40	0	
G_i/z	0.15	0.25	0.24	0	0.16
$(Gi/z)2$					0.0256

Source*:* Researcher's own Calculation (2023)

Formally, the poverty severity index is expressed as follows:

$P_2 = \frac{1}{N}\sum_{i=1}^{N}(\frac{Gi}{z})^2$ ……..…(2.6)

The poverty severity index equation (2) can also be written according to Foster, Greer and Thorbecke (1984), as:

$P_\alpha = \frac{1}{N}\sum_{i=1}^{N} (\frac{Gi}{z})^\alpha$, α ≥ 0 ..... (2.7)

α measures the index to poverty sensitivity and the arbitrary poverty line represented by z.

The circumstances are such that, P_2 is simply the headcount index when α = 0, the poverty gap index when = 1, and the poverty severity index when α = 2. When α > 0 falls, it indicates a drop in living standards; people are becoming poorer, whereas the converse is true. It is feasible to divide the FGT into subgroups and calculate each subgroup's contribution to overall or societal poverty. The notion is unappealing and cannot be applied to non-income-based aspects of poverty, and the method does not clearly indicate what is the best value for money.

The results of quantifying poverty differ based on the poverty gap index, poverty severity index, and head count index. Coudouel et al. (2001) compared the poverty gap index, head count index, and poverty severity index for Madagascar in 1994 as portrayed in Table 2.4 and found variances in poverty findings depending on the three measures of poverty on the same data. While the results for the poverty gap and head count in Madagascar were found to be closely related, the results for the poverty severity index were considerably different from those for the head count.

Table 2.4: Comparison of poverty gap index, head count index and poverty severity index

Orientation	**Head count %** **Po**	**Rank**	**Poverty gap %** **P1**	**Rank**	**Poverty severity %** **P2**	**Rank**
1.Start up farmers	81.6	1	41.0	1	24.6	1
2.Big farmers	77.0	2	34.6	2	19.0	2
3.Untrained workers	62.7	3	25.5	4	14.0	5
4. Fisherman	51.4	4	27.9	3	16.1	3
5. Pensioners	50.6	5	23.6	5	14.1	4

Source: Coudouel *et al. (*2001)

The poverty severity index exposes poverty across categories and is part of a study to identify poverty across Zimbabwe's ten provinces. However, the hypothesis offered does not explain why poverty differs with orientation (groups), such as urban and rural groups.

2.7.1.1.5 Sen Index

Sen (1976: 293-298) developed the axiomatic poverty measure, which estimates societal poverty using the poverty line, utility, and individual income characteristics. Sen's axiomatic poverty assessment methodology differs from standard methodologies in that it employs complicated mathematical indicators for income and expenditure.

Assumptions of the Axiomatic Model:

- The model assumes that poverty measure is grounded on some quantification of utility loss whose spectrum is formulated by the deprivation of the poor.
- Assumes individual utility depends only on the individual's level of income.
- Assumes rank order method decision for equi-distance.

The Sen's Axioms are:

- Focus Axiom- $\boldsymbol{P}$ ($\boldsymbol{x}$; $\boldsymbol{z}$) = $\boldsymbol{P}$ ($\boldsymbol{y}$; $\boldsymbol{z}$) whenever $\boldsymbol{x} \in \boldsymbol{D}$ and is obtained from $\boldsymbol{y} \in \boldsymbol{D}$ by an increase to a non-poor population, the poverty index must be independent of those above the poverty line (independent of the non-poor population).
- Weak Monotonicity Axiom- $\boldsymbol{P}$ ($\boldsymbol{x}$; $\boldsymbol{y}$) > $\boldsymbol{P}$ ($\boldsymbol{y}$; $\boldsymbol{x}$), every time a decrease in poor individual's poverty, ceteris paribus, constant leads to higher poverty measure.
- Impartiality Axiom - requires poverty index to be perfectly defined over ordered incomes of the poor without losing generality of poverty.
- Weak Transfer Axiom- $\boldsymbol{P}$ ($\boldsymbol{x}$; $\boldsymbol{z}$) < $\boldsymbol{P}$ ($\boldsymbol{y}$; $\boldsymbol{z}$) ($\boldsymbol{P}$ ($\boldsymbol{x}$; $\boldsymbol{z}$) > $\boldsymbol{P}$($\boldsymbol{y}$; $\boldsymbol{z}$) whenever $\boldsymbol{x} \in \boldsymbol{D}$ and is obtained from$\boldsymbol{y} \in \boldsymbol{D}$, which means that a rise in the poverty index occurs when the poorest (poorest) of any two ordered persons receives an upward transfer of income but the poor's income resource does not change.
- Strong Upward Transfer Axiom-$\boldsymbol{P}$ ($\boldsymbol{x}$; $\boldsymbol{z}$) < $\boldsymbol{P}$ ($\boldsymbol{y}$; $\boldsymbol{z}$) whenever $\boldsymbol{x} \in \boldsymbol{D}$ and is obtained from $\boldsymbol{y} \in \boldsymbol{D}$. A rise in the poverty index happens if the poorer of the two ordered individuals involved obtains higher income is poor. This implies weak transfer axiom.
- Continuity Axiom- $\boldsymbol{P}$ ($\boldsymbol{x}$; $\boldsymbol{z}$) is a continuous function of $\boldsymbol{x}$ $\boldsymbol{on}$ $\boldsymbol{D}$ for any given $\boldsymbol{z}$. Poverty index must continuously vary with incomes.

- Replication Invariance Axiom- $\boldsymbol{P} = (\boldsymbol{x}; \boldsymbol{y}) = \boldsymbol{P}(\boldsymbol{y}; \boldsymbol{z})$ whenever $\boldsymbol{x} \in \boldsymbol{D}$ and is obtained from $\boldsymbol{y} \in \boldsymbol{D}$ if the poverty index is generated on the basis of a distribution of income that is spawned k-fold replica of the initial income distribution, the poverty index does not change

Although scholars believe that the axioms are ethically acceptable, the first four axioms are the most commonly applied. Sen's multiple sensitivity axioms, according to Foster et al (1984), are rarely employed, but they are significant in advancing the Sen's poverty index.

Sen (1976)'s poverty index was developed from the headcount method (H), ($H = \%n$) and the poverty gap ($g_i = \pi - y_i$) which use poverty line to aggregate people whose income falls short of poverty line (Sen, 1979).

Equation (1) is closely related to the poverty gap index which can be given as:

$I = \sum_{t\varepsilon(S\pi)} {}^{gi}\!/_{qn}$ …… (2.8)

Equation (1) is the typical poverty gap index, which counts the total number of people whose income is less than the poverty line π. Equation (1) can then be represented as follows:

$P = A(\pi, q, n) \sum_{t\epsilon S(n)} g_i v_i$……(2.9)

where P is the poverty measure which is the weighted sum of income shortfalls who are defined as poor.

$S(\pi)$ stands for the number of poor people

v_i is the utility of each person which is assumed to depend only on income

g_i is the arbitrary poverty line

i is the ith person q is the poorest person by order of ranking individual income The relative deprivation thus can be estimated as follows:

$v_i = f(r(i))$…….. (2.10)

where:

f is an increasing function;

v_i is the utility of each person which is assumed to depend only on income;

$r(i)$ stands for the rank of i person in order of all individuals experiencing poverty in the order of decreasing income such that i is the poorest person among the poor. If the poor people have similar income, the ordering can be arbitrary ranking.

The poorest have the largest rank represented by q and the least poor is shown as *i*, the greater the rank the poorer an individual is in respect to others in terms of deprivation as measured by income insufficiency.

From equation (2) we can produce identity mapping which indicates ranked deprivation or Ranked Relative Deprivation (Axiom R) follows:

$v_i = r(i)$…… (2.11)

The above axiom indicates income distribution among the poor.

We can also generate the Axiom A or sometimes called the Normalized Absolute Deprivation, which can be shown as follows:

$P = HI$ …… (2.12)

From equation (4) Axiom R and (5) Axiom (A)

$P = H\,[I + (1 - I)\,G]$ …… (2.13)

where G denotes the Gini coefficient, which represents the distribution of income among the poor. Equation (6) is the updated Sen's index, which now satisfies both the continuity and strong transfer axioms that the Sen's index violates.

When inequality is zero, G=0, hence becomes $P = IH$ which is made of absolute deprivation and the ratio deprivation of those deprived.

According to Sen (1979), income redistribution would result in relative deprivation if some people became poorer while others became richer (but still below the poverty line). A transfer from a poor person (1) to a richer person (2) boosts (2)'s income and hence eliminates his deficiency. However, (2) has a lower poverty weight and therefore, this increases the poverty measure.

Sen's poverty metric has been utilised to evaluate poverty in many different communities and countries, and it is more useful than the traditional head count and poverty gap ratio, owing to 'the intuitive geometric interpretation' (Shorrocks, 1995; Xu & Osberg, 2012). Furthermore, the P measure can be changed, yielding other poverty metrics ranging from P1 to P6 (Sen, 1979:304). The axiomatic technique has various advantages, including axiomatization, which allows for things like 'it has numerous alternatives permissible which can be employed to give more poverty interpretations' (Sen, 1979). The multiplicative decomposition structure, which is a product of the poverty rate and the average poverty gap ratio (Xu & Osberg, 2012), is one of these.

Sen's axiomatic technique has another advantage, according to Xu and Osberg (2012), in that "it can be justified at both theoretical and ethical soundness, and it is easy to communicate with the general public." According to Xu and Osberg (2012), an axiomatic poverty measure can be used to combine the number of poor people, the depth and distribution of poverty within the economy to develop a poverty measure.

Formally, this is presented as follows:

$$P_s = P_0(1 - (1 - G^P)\frac{\mu^p}{z}) \quad \text{..... (2.14)}$$

P_0 is the head count index, μ^p is the poor's mean on income or expenditure

G^p is the Gini coefficient which indicates the level of inequality among the poor individuals. G^p ranges from 0 to 1, G^p of 0 implies perfect equality while G^p of 1 signifies presence of perfect inequality.

Sen's Index can be shown as follows:

$$P_s = P_0 G^P + P_1(1-G^P) \quad \text{..... (2.15)}$$

P_s refers to the mean headcount and poverty gap weighted by G^p of the poor

According to Osberg and Xu (2002) Sen's poverty index can also be shown as follows:

$$P_s = P_0 \; {P_1}^p \; (1 + G^{pp}) \quad \text{..... (2.16)}$$

G^{pp} stands for the Gini coefficient for the poor individuals only ${P_1}^p$ measures the poverty gap index of the poor.

The Sen's index has not been fully utilised beyond academics because it is a sophisticated measure compared to other measures. According to Deaton (1997), there is agreement that it cannot be used to breakdown poverty into contributions from distinct sub-groups. Liberati (2015), on the other hand, attempted to dissect it using Gini Index analysis. Foster, Greer, and Thorbecke (2010:518) recommended reexamining the poverty line and poor identification to improve the axioms technique, stating that axioms may be reformed to apply to the full methodology of poverty measurement, including the identification and aggregation step. The argument makes sense because the method of identification has remained consistent since Rowntree (1901) defined it as being in primary poverty when total earnings were insufficient to purchase the basic necessaries for the maintenance of merely physical efficiency. The second challenge which is inhibited in this axiomatic measure is that the model is purely income based therefore it certainly excludes dimensions such as social, political and environmental factors which are non-monetary aspects of poverty. Sen's theory is crucial for

this study as it enables the study to have introspection into poverty dynamics. To be exact, these assumptions enable the research objectives such as transmission, duplication, weak transfer and continuousness to be used to explain poverty in the context of Zimbabwe provinces and hence effectively meet the study objectives.

2.7.1.1.6 Sen-Shorrocks-Thon Index (SST) by Sen, Shorrocks and Thon (1983)

The poverty index proposed by Shorrocks (1995) was based on the pioneering work of Sen (1976). It received the name of modified Sen index in Shorrocks (1995) and Sen (1997). As noted by Zheng (1997), this index is identical to the limit of Thon's modified Sen index (Thon, 1979 and 1983). SST is the modified Sen's poverty measurement index. The measure can be shown as:

$$P_{SST} = P_0 P_1{}^{P}(1 + \hat{G^{p}}) \quad \text{..... (2.17)}$$

The (SST) is calculated by multiplying head count indicators, poverty gap indices, and the Gini coefficient of the community's population. A Gini coefficient close to one suggests greater poverty disparity.

Osberg and Xu (1999) used the SST index approach to determine provincial poverty in Canada between 1984 and 1995. The SST index's key advantage is that it can be easily deconstructed further to provide sources of poverty variations over time, as demonstrated below:

$$\Delta lnP_{SST} = \Delta lnP_0 + \Delta lnP_1^{P} + \Delta ln(1 + \hat{G}^{p}) \quad \text{.....(2.18)}$$

The above function in equation (2) means that percentage change in SST is equal to headcount index percentage change plus poverty gap percentage change for the poor + (1 + Gini coefficient of the poverty gaps). This decomposition allows for further investigations into the poverty trends and answering key questions such as:

- Are there more poor people in the country?
- Is the poor poorer over a given time?
- What is the level of inequality in the country among the poor?

Amongst its many benefits, the SST model is straightforward to understand, simple to compute, and allows for additional sub-group breakdown (Xu & Osberg, 2012). The bootstrapping approach is frequently used since the SST method is difficult to utilize for building confidence intervals. Bootstrapping is a replacement sampling approach where artificial sampling is used. Between 1984 and 1995, the SST index on Canada's Newfoundland was found to be ineffective, as Osberg and Xu came to the conclusion that the majority of the

periodical changes in the rate of poverty were caused by deprivation rather than the poverty gap or the proportion of the population living in poverty (Osberg & Xu, 1999). The SST index, like Sen's earlier theory, allows the study to comprehend poverty dynamics, which is a component of this study.

2.7.1.1.7 Foster, Greer and Thorbecke

The Foster, Greer and Thorbecke (FGT) model for poverty measurement was developed in 1984 based on the following assertions:

- The measure is decomposable into subgroups.
- It fulfils Sen's Capabilities Approach
- It satisfies relative deprivation

The element of decomposability implies that the total population index is produced from numerous subgroups aggregated together within the society in question. This also implies that changes in subgroup poverty have an impact on total poverty for the society; thus, population poverty is the weighted total of subgroup poverty. The idea is that a person or household cannot be deprived of one dimension without also being deprived of the other.

Formally, this is expressed as follows:

$$\Pi_{\alpha} = \int 1(y < z)(1 - \frac{y}{2})\alpha \mathrm{dP} \quad \text{..... (2..19)}$$

where, α represents a class of poverty measures and Π_{α} satisfies the monotonicity axiom for values $\alpha > 0$.

At $\alpha > 1$, the index satisfies the transfer axiom $\alpha > 2$ represent the sensitivity axiom

The cross-sectional analysis of FGT or Pα thus can be shown as follows

$$P\alpha(\mathrm{y,z}) = \frac{1}{n}\sum_{i=1}^{q}(\frac{z-y_i}{z})^{\alpha} \text{ if } y_i \leq z_i \quad \text{..... (2.20)}$$

where:

z is the arbitrary poverty line; n represents the sample size; q is added total number of families below poverty line; (α) stands for poverty aversion and when the value is high, it signifies higher poverty and small number means low poverty (Foster, Greer & Thorbecke, 1984; Metzler, 2014).

The $P\alpha$(y, z) is affected by α as follows:

When α = 0, $P\alpha$(y, z)the head becomes count poverty index;

If α = 1, $P\alpha(y, z)$ will be the per capita income gap index and lastly;

When α = 2, $P\alpha(y, z)$ becomes the capita gap index squared and it places emphasis on households below the poverty (Foster, 2012) and this was also noted earlier by Dasgupta, (2006) that squared poverty (poverty severity) gives more information on poverty and inequality The literature is scant on FGT studies for Zimbabwe. Ferre' et al. (2012), on the other hand, employed FGT on eight impoverished countries (Albania, Brazil, Kazakhstan, Kenya, Mexico, Morocco, Thailand, and Sri Lanka) to assess the relationship between city size and poverty circumstances. The study concluded that FGT (0), which measures poverty intensity, and FGT (1), which measures poverty depth, were higher in smaller countries than in larger countries such as Brazil and Mexico. The use of poverty lines by FGT is significant in explaining the dynamics of poverty across groups or regions, and it is one of the study's empirical objectives.

2.7.1.1.8 The Watts index

Harold W Watts introduced it in 1964 (Watts, 1968) for a distribution-sensitive measure of poverty and its discrete form which is as follows, as illustrated by equation 2.21:

$$W = \frac{1}{N}\sum_{i=1}^{q}[\ln(z) - \ln(y_i] \quad \text{..... (2.21)}$$

where N represents impoverished persons (q) in the population indexed to their spending or income (*yi*) in increasing order, and (z) represents the poverty line. Watts' index is calculated by dividing the poverty line by income and then calculating the average of the poor using logarithms. The preceding equation can be rewritten as in equation 2.22 as follows:

$$\Pi_w = \int 1(y < z) ln\frac{y}{z}) dP \quad \text{.....(2.22)}$$

The Watts index in equation (2) has been praised for meeting all of the theoretical properties fundamentals for a good poverty index and is increasingly being used by researchers in generating poverty incidence curves; however, it is not a particularly intuitive measure, and thus seldom appears in practical field work (Muller, 2011). Watts' index satisfies Sen's monotonicity axiom, which states that any reduction in income for the poor raises the poverty measure, as well as Kakwani's transfer-sensitivity axiom. Although there is no indication that this model has been utilised to measure poverty in Zimbabwe, the idea is crucial in emphasising that money is a factor of poverty. However, the theory ignores many other poverty indicators that are difficult to articulate in accordance with mathematical presentations. In the case of Sub-Saharan Africa, this study will determine poverty using income and a variety of other factors.

The method is related to the SST. The index takes the form:

$P = \frac{1}{N}\sum_{i=1}^{N} P(z, y_i)$ ……..……(2.23)

where ((z, y_i) is the individual poverty measure. For the non-poor, ($z > y_i$) takes the value of zero, the index takes positive values for($z < y_i$), implying the existence of poverty. The theory clealy distinguishes between poor and non-poor which indicates occurrence of poverty bands.

This is critical to the current study's goals, which are to explain poverty per each province in Zimbabwe. However, the theory does not effectively reflect poverty dynamics faced by each group such as the province in this current discourse.

2.7.1.1.9 Bayesian Gini Index

The Bayesian Gini Index is used mainly in the case of pareto optimality to measure income inequality (Mahajan *et al.*, 2015), where the Gini index or Gini coefficient or Gini ratio is given as:

$G = \frac{\Delta}{2\mu}$ …… (2.24)

Δ is the population mean difference which is given below;

Where $\Delta = \int_0^{\infty}\int_0^{\infty} |x - y| f(x) f(y) dxdy$……(2.25)

G ranges between 0-1, where 0 indicates (100%) income equality and 1 means (100%) income inequality. Conversely, the Gini index is the area under the Lorenz curve; given as G= (1- 2).

G = (1-2) $\int_0^1 L(p)dp$, 0≤p≤1 …… (2.26)

Where $L(p) = \frac{1}{\mu}\int_0^p F^{-1}(t)dt$……(2.27)

Equation (4) is the Lorenz curve.

μ from equation (3) is given as

$\mu = \int_0^1 F^{-1}$dt……(2.28)

Equation (5) is the mean distribution associated with income inequality. This method is closely related to the Foster *et al* method.

The Bayesian Gini index is not practicable in practise because to the difficulties in identifying the prior distribution, which is taken from historical data or the researcher's experience. Due

to a lack of prior distribution information and time constraints, the method is rarely applied, reducing the robustness of the Bayesian Gini Index (Mahajan et al. 2015).

2.7.1.1.10 Monetary approaches wrap-up

Generally, monetary approaches and methods are the most common poverty measures used by the World Bank, UNDP and ZIMSTAT, especially given that the multidimensional poverty measures are a recent phenomenon, and the UNDP endorsed its validity in 2011. The money metric poverty measures such as the poverty line are "simple, easy to remember, and apply to all countries" for generic circumstances (Deaton, 2000). In further studies, Deaton (2001:138) summarises that: "…*in the World Bank's calculation of the number of poor in the world, separate urban and rural [price] indices are used only for India and China. In other countries, a single index does service for everyone, an expediency that must overstate rural relative to urban poverty."* This makes the World Bank's monetary measure an inefficient measure that lacks endogeneity.

Additionally, the World Bank poverty measure is based on a belief of perfect fungibility of all goods and services' conversion into monetary value, such as the valuation of subsistence production or the valuation of public goods utilities that an individual benefit from using (Grosh & Glewwe, 2000; Laderchi et al. 2003; Barnum & Tan 2022). The monetary approach's welfare or utility maximisation behaviour remains controversial since the assumptions are not necessarily necessary for human behaviour (Laderchi et al., 2003; Dzogbenuku et al., 2022). Consumption is being reduced for health reasons, and there is a deliberate growth in services that are difficult to quantify. The monetary approach can only be valid when the following conditions define poverty:

- When welfare or utility is the sufficient condition for measuring wellbeing
- If monetary expenditure and or income is a necessary, measure of wellbeing
- When poverty is solely defined as shortfall in welfare or utility
- When there is enough justification for a given poverty line

The monetary approach to measuring poverty is geared towards income and does not capture the entire scope of multidimensional poverty. The method is more of a shortcut to poverty analysis that employs monetary indicators for ease of use. It is based on readily available data to fully identify poor people within society in dimensions other than resource deprivation (Laderchi et al. 2003, Dzogbenuku et al, 2022).

Another weakness to the monetary approach's applicability is determining where to draw the poverty line and how to properly distinguish between the poor and non-poor. The poverty line,

according to Laderchi et al., (2003), Liberati (2015), and Salehi et al. (2019), is a minimum cost of the poverty level of utility that is never fully defined in existing theory because it focuses on methodological aspects of the poverty line calculation rather than theoretical considerations.

Other research, such Stoeffler et al. (2016) and Diaz-Bonilla et al. (2022), have advocated that two distinct approaches should emerge from the monetary poverty line, namely the cost of essential commodities poverty line and the nutrition-based poverty line, which would evaluate food energy consumption. Because of variances in metabolism, size, age, gender, and personal preferences, determining the nutrition poverty level remains problematic (Salehi et al, 2019).

Moreover, poverty lines are formed at the household level on the assumption that financial resources are distributed equitably within the family, which is never the case. Women and children typically have lower resources than men (Laderchi et al. 2003). The monetary poverty measures do not account for this. Ravallion (2011) pushed the problem of poverty lines further, developing a relative poverty line for underdeveloped countries. According to Dotter and Klasen (2014), the poverty line should be located between a fixed absolute line, such as the international $1.25 per day line, and a purely relative one, though caution should be exercised because using a weakly relative poverty line results in the income poverty threshold being disproportionately high. The monetary poverty metric, on the other hand, has a problem in aggregating poverty from the individual to the communal level. Sen's (1976) and FGT's (1984) improvements are still insufficient since aggregate values are tied to social valuation, which undermines the monetary poverty measure.

In general, the World Bank, IMF, and UNDP continue to utilise the monetary technique to measure poverty at the national, regional, and international levels. Nonetheless, the monetary approach to measuring poverty fails to account for the variability of individuals within a home, community, country, or between countries (Mitlin & Satterthwaite, 2012).

The World Bank monetary poverty measurement of one US$2.15 per day, in accordance with the World Bank (2022), has been challenged because it does not clarify tenets such as nominal exchange rate, purchasing power parity (PPP), and the bread basket of goods that can be purchased with the US$ amount, which varies by country (Nye, 2002; Reddy, 2002). Furthermore, the World Bank's US$ amount per day principle is affected by inflation; for example, the United States suffered inflation from 1985 to 1993, hence the World Bank's poverty line should vary by (8%) when assessing and measuring poverty from 1985 to 1993 (Deaton, 2010).

Yet, adjusting figures to align with the inflation index for the PPP introduces distortion to the true inflation levels over the specified timeframe. This distortion arises from the strengthening of the PPP international dollar compared to the currencies of the impoverished nations for which the line was established. It is observed that the PPP method, involving extrapolation and imputation of unavailable data to describe national income/consumption levels, can result in erroneous inferences and conclusions about the extent and seriousness of global poverty (Deaton & Bettina, 2017).

Employing monetary measurement via the creation of USD$/PPP exchange rates presupposes that the prices of goods and services are exchanged without the influence of tariffs and trade barriers like import restrictions, trade permits, quotas, and transportation costs, among other protectionist measures in different countries. Additionally, these monetary metrics fail to account for substitutions made by the poor and do not adjust for variations in local staple foods, considering that what is considered a staple in one country may be a luxury in another (Deaton & Bettina, 2017).

The daily USD$ amount used in poverty measurement doesn't specify the essential goods and services required for individuals to fulfill their basic life needs. Relying on defining poverty based on those living below a certain US$ amount per day is deemed unreliable for the formulation of poverty eradication and management policies and programs, as highlighted by Deaton (2000). Reddy and Pogge (2000) emphasized the lack of consistent correspondence in these measures for the poor, citing a cluster study that found poverty lines often fall below the level designated for poverty measurement, while other lines project well above the international poverty threshold. Estimating poverty using monetary poverty lines is systematically influenced by the year in which the measurement takes place.

To address the limitations of the poverty line measurement method, Deaton suggested "creating a PPP exchange rate tailored to a relevant bundle of goods that fulfill the needs of the poor, thereby imbuing greater significance to the established line" (Deaton & Bettina, 2017). Blackorby and Donaldson (1988) proposed the use of welfare ratios, employing indifference curves to distinguish between the poor and non-poor as an alternative to PPPs. Satterthwaite (1997; 2001:146) presented a list of economic factors supporting a more comprehensive poverty measurement, encompassing "eight aspects of urban poverty: inadequate income; unstable or risky asset base; insufficient shelter; deficient public infrastructure; inadequate provision of basic services; limited or no safety net; insufficient protection of poorer groups' rights through legal mechanisms; and the voicelessness and powerlessness of poorer groups." Some of these dimensions and indicators necessitate multidimensional approaches, making them challenging to easily quantify in monetary terms.

2.7.1.2 Social Exclusion poverty measurement

In the 1970s, the term "les exclus" was used in France to describe individuals facing various challenges such as mental or physical disabilities, elderly invalids, drug addicts, single parents, and social misfits covered by social security programs. Davies (2005) credited Rene Lenoir with introducing the concept of social exclusion during this period. The Townsend proposition, linking deprivation to individuals lacking normal living standards, is closely associated with the concept of social exclusion (Townsend, 1979:31). In industrialized nations, social exclusion was coined to depict marginalization and deprivation processes even in wealthy countries with extensive welfare programs (Laderchi et al., 2003).

Social exclusion examines how individuals or groups are either fully or partially excluded from complete participation in the society where they reside (Clert, 1999). The European Union and its social policy, including the Lisbon Council of March 2000, use social exclusion as a method for measuring poverty. This approach has also been extended to developing countries through the UN (Clert, 1999). According to Laderchi et al. (2003), social exclusion occurs when an individual in society (a) cannot participate in activities they normally should and (b) would like to participate if given the opportunity. Barry argued that a person is excluded if conditions (a) and (b) persist despite their willingness to participate (Deaton and Bettina, 2017).

In Zimbabwe, the government's Department of Social Welfare, under the Ministry of Public Service, Labour, and Social Welfare, aims to reduce poverty among the disadvantaged population through family and social protection services, rehabilitation and Private Voluntary Organization (PVO) Administration, as well as policy and projects. Government programs include social cash transfers to the poor in rural areas, particularly for the elderly, vulnerable, orphaned, and physically handicapped. In 2018, a total of USD$500 million was allocated to socially excluded individuals across Zimbabwe. The Food Deficit Mitigation Programme assists people facing acute food shortages by providing maize and a monthly allocation of cereals to the poor and vulnerable. Health and public assistance are also offered to the socially excluded. Major partners in Zimbabwe's social programs against social exclusion include the European Union, Spotlight Initiative, Royal Norwegian Embassy, Centre for Applied Legal Research (CALR), World Vision, and Schweizerische.

Social exclusion in Zimbabwe involves providing unconditional monthly cash allowances for the maintenance of disadvantaged and vulnerable households. The concept extends to delinquents, multi-problem households like single-parent households, women-headed families, and families with unemployed breadwinners. These individuals are excluded from basic political, social, economic, and cultural dimensions (Evans, 1998; Stewart et al., 2007; Hick, 2012; Hungwe, 2022). Social exclusion encompasses various aspects beyond resource

insufficiency (Burchardt et al., 2002), allowing for a focus on both individuals and groups where group membership itself is a cause of exclusion (Stewart et al., 2007). According to Hick (2012) and Hungwe (2022), social exclusion broadens poverty analysis in three crucial aspects: it enables analysis from a community perspective rather than an individual perspective, facilitates a shift from predominantly unidimensional poverty analysis to multidimensional analysis, and promotes dynamic poverty analysis rather than static analysis.

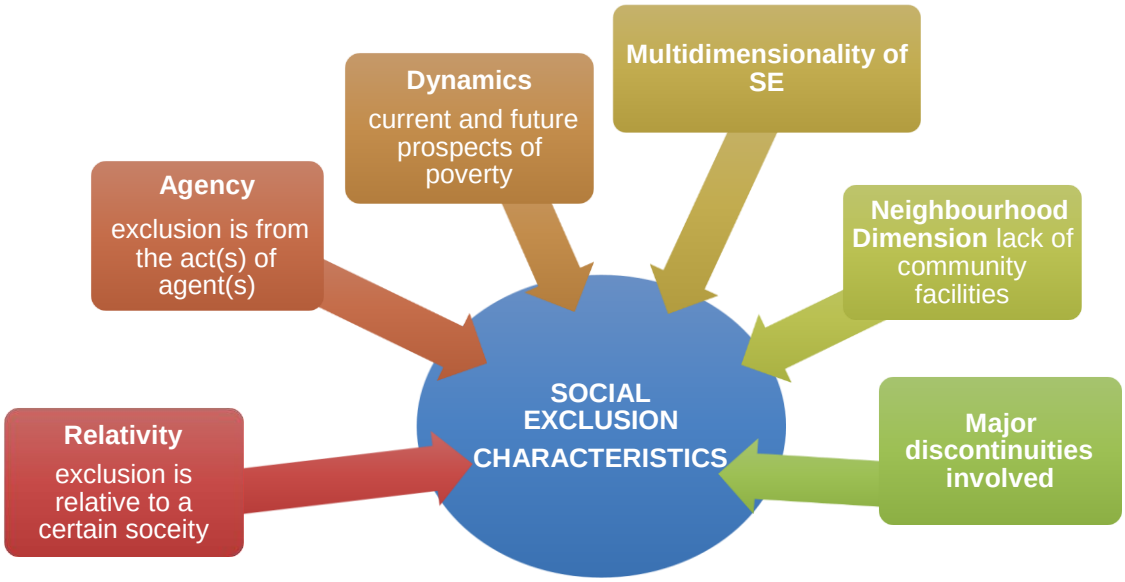

Figure 2.4 The main characteristics of Social Exclusion
Source: Atkinson, (1998)

Figure 2.4 illustrates the key elements of Social Exclusion. However, these features of a social exclusion approach face challenges, primarily due to a lack of clarity regarding the measure's specific objectives. The representation does not clearly distinguish whether social exclusion is a process or an outcome; it merely counts the number of socially excluded individuals, notes their characteristics, but does not track the process to identify the causes of entry or exit into poverty (Hick, 2012). Nevertheless, the concept of Social Exclusion is frequently employed to explore a broader conceptual landscape in poverty measurement (Hick, 2012). One of its advantages is its dynamic nature, setting it apart from the Capabilities Approach (Stewart et al., 2007).

It's unfortunate that certain crucial aspects are not distinctly defined in Social Exclusion, such as the implications of using the concept of normalcy. Laderchi et al. (2003) criticize Social Exclusion, stating that "lack of formal sector employment or social insurance coverage does not necessarily imply exclusion from normal social patterns or relationships. Determining what

is 'normal' can be challenging, as the normal may not always be desirable, and defining the benchmarks of exclusion becomes problematic" (Laderchi et al., 2003:259). Micklewright (2002:7) also observes that "exclusion is a concept that defies clear definition and measurement." Applying Social Exclusion in developing countries is challenging because defining normality is particularly difficult in multipolar societies, and conflicts can arise between what is considered normal and what is deemed desirable (Micklewright, 2002:7).

2.7.1.3 Capability Approach poverty measurements

Sen (2010) criticized monetary poverty measures for their insensitivity to income redistribution among the poor, proposing an axiomatic approach that defines poverty as a condition of deprivation of capabilities. The Capabilities Approach rejects the utilitarianism of monetary income as a measure of well-being and instead emphasizes the freedom to live a valued life. According to Sen (1993), life is viewed as a collection of "doings and beings," referred to as functionings, which relate to the evaluation of the quality of life and the assessment of the capability to function.

In Sen's framework, poverty is seen as deprivation, indicating a failure to achieve certain minimal standards set by society that would reduce mortality and morbidity. Deprivation includes a lack of basic capabilities such as adequate nutrition, liberty, normal mobility, self-confidence, self-respect, and full participation in societal projects (Sen, 1993; Laderchi et al., 2003).

The Capabilities Approach measures well-being as individual freedom, considering both physical and valuation neglect (Laderchi et al., 2003). Sen recognizes that a lack of income can be a primary reason for capability deprivation and a predisposing condition for an impoverished life (Sen, 1999).

Hick (2012) notes that the Capabilities Approach highlights various ways in which human life can be blighted, focusing on what people can do rather than what they have or feel. Sen proposes a shift in the analysis of poverty and well-being from predominantly focusing on "means of living" such as expenditure and income to the "actual opportunities an individual has" (Sen, 2009). The focus is on real or "substantive freedoms" rather than formal ones, as functionings are constitutive of a person's being, and an evaluation of well-being involves an assessment of these constituent elements (Sen, 1993).

The Capabilities Approach serves as an alternative poverty measurement approach, abstracting human behavior, measuring well-being, and determining policy objectives based on non-utilitarian and utility maximization behavioral assumptions. Monetary aspects are seen

as a means of enhancing well-being rather than the ultimate outcome of interest (Sen, 1993; Laderchi et al., 2003).

Functionings represent various aspects a person accomplishes "in doing or being," such as community participation, while capabilities define the substantive freedoms needed to achieve these functionings, including the ability to participate in societal life activities (Sen, 1999). The Capabilities Approach considers capabilities to function, capabilities to freedom of choice, capabilities to agency role, and capabilities to self-esteem as essential components of well-being.

While the Capabilities Approach provides a multidimensional perspective on poverty, it has faced criticism. Mowafi (2019) acknowledges Sen's main advantages: the emphasis on intrinsic poverty beyond income, recognition of determinants of capability deprivation beyond income poverty, and acknowledgment of the varying connection between low income and low capability across communities, families, and individuals.

However, Sen's weakness, as highlighted by Mowafi (2019), is the lack of clarity on whether the immediate goal is complete capability equality. Nussbaum suggests that the immediate task is to bring the poor above a minimum threshold before addressing the demands of what to do when everyone is above that threshold. Lister (2004) criticizes Sen's Capability Approach for not considering all capability deprivations as arising solely from a lack of resources.

The Capabilities Approach's focus on what humans can do in their lives, ignoring feelings or possessions, has been considered biased by some critics (Hick, 2012). Walker (2006) argues against the fixed and canonical nature of the list of capabilities, suggesting that it should be flexible, not hierarchically ordered, and should include participation and dialogue for specific purposes or evaluations.

In summary, the Capabilities Approach offers a unique and multidimensional perspective on poverty, emphasizing intrinsic values and freedoms beyond income. However, it faces challenges and criticisms regarding its clarity, application, and consideration of various aspects of human life.

2.7.1.4 Nussbaum’s Capability Approach poverty measurement

Nussbaum (2000) formulated a theory closely aligned with Sen's (1976), aiming to systematically address the incompleteness of Sen's capability approach. Sen acknowledged that Nussbaum's approach could effectively eliminate this incompleteness (Sen, 1993:47). Both researchers share the belief in the significance of freedoms in development, emphasizing that political and economic rights are equally vital and should not be considered separately.

They also critique Rawls' (1971) theory of social justice and utilitarian methodologies. However, Nussbaum goes a step further by explicitly distinguishing her principle of each person's capability and defining a threshold level of capabilities that must be attained to ensure everyone can secure a necessary level of human dignity (Mowafi, 2019).

According to Nussbaum (2000), a crucial task is to bring every member of society above a minimum threshold, which she acknowledges is a formidable challenge. Her theory proposes the establishment of minimum universal capabilities that must meet certain standards (Nussbaum, 2000).

Nussbaum (2000) presented a list of freestanding moral cores for a political conception, emphasizing that this list does not require acceptance of any specific metaphysical, ethical, religious view, or particular perspective on the person or human nature. It is an open-ended and adaptable list that can be revised to accommodate differences in societal and cultural contexts. Nussbaum's theory encompasses three types of capabilities: Basic Capabilities, Internal Capabilities, and Combined Capabilities. These categories are further detailed below.

- Basic Capabilities: These are the fundamental capabilities that serve as a prerequisite for the development of more advanced capabilities.
- Internal Capabilities: These are specific to individuals and may require additional time and training to develop.
- Combined Capabilities: These capabilities are innate to an individual, but require external support from the community, government, and family to develop.

Table 2.5 shows aspects of Capabilities by Nussbaum.

Table 2.5 Nussbaum's List of Capabilities

	Dimensions	**Indicators**	
1.	Life	a.	Prevention of early and premature death
2.	Bodily health	a.	Being adequately nourished
		b.	Having generally good health
		c.	Having god reproductive health
		d.	having shelter
3.	Bodily integrity	a.	having general, oneself bodily control such as
		b.	protection from assault
		c.	prevention of child abuses
		d.	having reproductive choices
4.	Senses, Imagination and thought	a.	use their sense of reason and being protected by political freedoms and enough education

5.	Emotions	a.	being free to love,
		b.	being free to grieve,
		c.	freedom to experience longing,
		d.	freedom for gratitude and justified anger,
		e.	free from overwhelming fear or anxiety;
6.	Practical Reason:	a.	having freedom to form a personal conception of the good and to plan one's own life;
7.	Affiliation	a.	having freedom to engage in various, and personally determined,
		b.	freedom for social interactions,
		c.	being free from humiliation,
		d.	having the social bases of self-respect, and
		e.	having protection from all forms of discrimination
8.	Other Species	a.	being able to interact freely with nature;
9.	Play	a.	being able to laugh, play, and enjoy recreational activities;
10.	Control over One's Environment	a.	having fundamental political and economic rights such as
		b.	guarantees of political participation,
		c.	ownership of property, and
		d.	equal opportunity to employment.

Source: Nussbaum (2000)

Sen opposes the idea of establishing a fixed set of capabilities and emphasizes the "deliberate incompleteness" of the capability approach. He asserts that valuation ranking and individual choice are crucial prerequisites for the experience of freedom (Mowafi, 2019). Mowafi (2019) challenges Nussbaum's proposition of eliminating religious and ethical considerations altogether, suggesting that people globally could potentially reach agreements on a set of capabilities independent of metaphysical, religious, or ethical concerns.

In response to Nussbaum's theory, Sen acknowledges that while it may be highly specified, the capability approach itself does not mandate taking that specific route. The deliberate incompleteness of the capability approach allows for alternative routes that also have some plausibility (Sen, 1993:47). Despite being considered an alternative capability approach to poverty measurement, Nussbaum's theory has faced criticism for veering towards an

evaluative process in practice. It also falls short in addressing the question of who decides which capabilities are universally valuable.

2.7.1.5 Participatory Approach poverty measurement

The monetary approach, capabilities approach, and social exclusion approach face criticism for being externally imposed measures that do not consider the perspectives of poor individuals in poverty measurement and analysis. According to Laderchi et al. (2003), the participatory approach (PA), first introduced by Chambers (1994), aims to involve poor people directly in decisions about the meaning and experience of poverty in their lives. Mowafi (2019) highlights the significance of allowing the poor themselves to inform poverty assessments.

The participatory approach is defined as "a growing family of approaches and methods that enable local people to share, enhance, and analyze their knowledge of life and conditions, to plan, and to act" (Chambers, 1994:57). Initially used for participatory poverty assessments (PPA), particularly in participatory rural assessments (PRA), PA gained prominence in small community-level projects for poverty measurement before its adoption by the World Bank (Laderchi et al., 2003).

Chu et al. (2022) outline three types of participatory approaches:

- PA related to self-determination, emancipation, or empowerment.
- PA related to increasing program efficiency.
- PA encouraging mutual learning.

Laderchi et al. (2003) and Mowafi (2019) emphasize that PA involves collecting society-specific information on cultural, social, political, and economic aspects within a locality. It determines well-being, perceptions, and indicators through social mapping and well-being groupings. Assets at the community or rural level, such as community property, access to services, and natural resources, are measured through resource mapping and focus group discussions. Household assets are determined using wealth ranking and analysis of poor households. Crisis management is assessed through livelihood analysis and structured interviews for ranking analysis. The PA uses institutional mapping and interviews with the poor to understand community-based support for poor households. Environmental aspects, such as pollution or soil fertility, are addressed through resource mapping, trend analysis, and historical transects in the PA process.

These are depicted in Table 2.5.

Table 2.5 Participatory approach implementation methodology

a. Measuring perception: wealth and wellbeing • Wellbeing grouping • Social mapping • Semi-structured mapping	b. Community assets and access to community services (public goods) • resource mapping • focus group discussions • instutionalized mapping • community based support programmes • historical transepts • trend analysis • resource mapping at a point in time
c. Household assets • Wealth ranking analysis • Livelihood analysis	Participatory Approach Method egies • livelihood analysis • structured interviews to the poor • ranking

Source: Laderchi *et al.* (2003)

The approach employs a diverse set of participatory methods, including mapping, periodic calendars, and household-level rankings of poor people's resources and welfare. This methodology offers a more comprehensive measure of poverty and increased flexibility, distinguishing it from other poverty measurement approaches.

In a practical example of Participatory Poverty Assessment (PPA), the World Bank utilized this method, resulting in the submission of 300 reports, with 78 becoming the renowned 'voices of the poor.' These reports were compiled from various regions, including 47 from Africa, 30 from the Middle East, 16 from Latin America, 12 from the Caribbean and South Asia, 10 from East European and Central Asian countries, and 10 from East Asian countries. Sample sizes varied, with most ranging between 10 and 100 communities, and some involving 100 to 5,000 people. The associated costs varied between $4,000 and $150,000 (Narayan et al., 2009). However, the non-uniformity of data across countries significantly impacted the comparability of results.

Øyen (2002) challenges the idea that "the poor are the true experts on poverty," suggesting that while the poor may be less technical in explaining their poverty, poverty conditions are not static—they perpetuate their circumstances. Øyen further contends that it is not necessarily the factors (indicators and dimensions) affecting anti-poverty efforts, such as

social networks and empowerment, but that poverty serves certain interests, such as those benefiting from cheap and flexible labor without commitment. Efficient poverty reduction, Øyen argues, is not possible without confronting adversaries and vested interests.

The study proceeds to compare the four discussed poverty measurement approaches using seven variables, from the unit of measurement to policy decision-making. This comparison aims to provide a clear analysis of the distinctions among these poverty measurement approaches, as outlined in Table 2.6.

Table 2.6: Comparisons of money metric, Sen's Capability, Social Exclusion and Participatory approach

Variable (s)	**Money metric measures**	**Sen' capability (CA)**	**Social Exclusion (SE)**	**Participatory Approach (PA)**
a) Unit of measurement	Individuals to derive household	Individual	Both individual and groups	Groups and individuals within groups
b) Minimum standard	Consumption information both external and internal	List of defined dimensions	Set Society standards	Society's own perceptions
c) Main weakness of conceptualizing	Utility based	Dimensions are arbitrarily chosen	Too broad and difficult to compare across societies	Perceptions of interviewed does not represent everyone's sentiments.
d) Inter-society comparisons challenges	Poverty lines (poverty datum lines) and price indices vary over space and time	Adding up methodology mostly applied under CA makes the concept difficult to apply across societies	SE lines vary from society to another	Varies across societies and comparison not objectively achievable

e) Challenges with Data accessibility and availability	Household surveys are not (100%) error proof and omitted variables affects results	Data sets not regularly collected or updated affecting efficiency of the measure	Largely rely secondary data sets collected for other aims	Data mostly not available for national measurement
f) Weakness in actual poverty measurement process	Use of arbitrary poverty lines not universal across societies	Multidimensional indicators and dimensions are too many	Data capturing process is too cumbersome	Comparison and representation of the data to society
g) Policy and decision making	Mainly for monetary growth aspects such as GDP and Inflation	Helps with advice on public services and human basic needs priorities for the country	Inclusion and social services delivery	Empowerment of the economically disadvantaged

Source: Researcher's own Calculation (2023)

2.7.2 Theories on measures of multidimensional poverty

2.7.2.1 Alkire and Foster (AF) Method of poverty measurement

The A–F multidimensional poverty index M_0 is a direct product of the headcount ratio of poor individual's H and mean deprivation share among the poor A

$$P\alpha(\mathrm{y},\mathrm{z}) = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^{\alpha} \text{ if } y_i \leq z_i \quad \text{.....(2.30)}$$

where terms (z, n, q and α) are z is the poverty line; n is the sample size; q is the number of poor families and;

(α) is a non-negative number symbolic of poverty aversion, where higher values emphasize the poorest of the poor (Foster, Greer & Thorbecke, 1984; Metzler, 2014).

The dual-cut-offs approach entails spending mandated resources in the same period as measured, without transfers across periods, and assigns equal weight to all spells without special treatment for early, late, or contiguous spells. Both the Pα and Kα, τ measures are decomposable, allowing for a closer examination of subpopulations (Metzler, 2014).

In a study by Stoeffler et al. (2016), the Alkire and Foster (2011) methodology was applied to measure poverty in Zimbabwe. The research utilized data from household surveys conducted by ZIMSTAT, using Income, Consumption, and Expenditure Surveys (ICES) and Poverty, Income, Consumption, and Expenditure Surveys (PICES) for the periods 2001, 2007, 2011, and 2012 to construct a multidimensional poverty index. The study concluded that there was a decrease in poverty in Zimbabwe, indicating a consistent recovery of the Zimbabwean economy from 2008 to 2012. The findings demonstrated a clear and significant decrease in poverty incidence between 2007 and 2011–2012 across all levels of k (−11.0% for k ¼ 3). However, the multidimensional poverty incidence was noted to be higher in 2011–2012 than it was in 2001, and the change between the two periods was relatively small but statistically significant for all k (+7.5% for k ¼ 3). These findings suggest that the recovery ameliorated the adverse effects of the economic crisis in aggregate across multiple dimensions, but the effect of the crisis on multidimensional poverty was still tangible three years into recovery.

The model disregards regional differences, assuming uniform living costs, and excludes factors like subsidies, tax credits, and food assistance. Metzler (2014) proposes that monetizing consumption and tax-based aid may partially bridge the income gap, potentially lifting a family out of poverty in terms of disposable income.

Sen (1976:219) argued in his influential 1976 article that poverty gap and headcount ratio indexes were insensitive to income distribution among the poor. He introduced a more intricate poverty index using the axiomatic method, satisfying desirable features. The axiomatic approach to measuring poverty delineates the morally justifiable features that should evaluate a poverty index (Xu & Osberg, 2001:155).

Sen (1976) formulated a list of axioms for plausible poverty indices, sparking interest in developing axiomatic multidimensional poverty metrics. Only a few studies (Chakravarty & D'Ambrosio, 2006; Chakravarty & Silber, 2008; Bossert et al., 2009; Tsui, 2002; Alkire & Foster, 2011b; Decancq, et al. 2012; Liberati et al, 2022) have attempted to axiomatically derive multidimensional poverty metrics, each providing different definitions of axioms. This examination focuses on the Alkire and Foster class of multidimensional measurements.

Sen's capabilities approach inspired the overall framework of the Alkire and Foster methodology, advocating a shift from considering means of subsistence to actual freedoms (Sen, 2009:253). Alkire and Foster's methodology, applied globally and nationally, is explored with its primary benefits and restrictions. A summary of axioms fulfilled by this method is also provided.

Sen (1976:219) identifies determining who is poor within the population and compiling poverty data throughout society as key elements in assessing poverty. These processes, integral to the conceptual model for measuring poverty, were considered in calculating poverty using Alkire and Foster's methods. The "dual cut-off" method identifies the poor by counting the number of (weighted) deprivations, and the aggregation method expands the unidimensional Foster-Greer-Thorbecke (FGT) family of measures to the multidimensional environment.

2.7.2.1.1 Identification

Distinguishing the impoverished from the general population in a unidimensional, income-centric study is relatively straightforward. Typically, poor individuals are identified using a threshold or poverty line, where those with resources (income or spending) below this line are considered poor. However, in a multidimensional measurement context, where multiple variables are considered, distinguishing the poor from the non-poor becomes a more complex task. The capacity method highlights a fundamental conceptual flaw in viewing multidimensional poverty through a unidimensional lens, leading to a lack of understanding of dimension-specific deficits (Alkire & Foster, 2011b:478). Unlike in most monetary poverty lines where dimensional attainments are combined before identification, deprivation cut-offs are not considered in this method (Alkire & Foster, 2011b:478). Independent assessments of dimensions reveal that certain dimensional deprivations are inherently undesirable. In this case, there is a compelling argument in favor of moving beyond a unidimensional perspective and adopting identification techniques that focus on dimensional deficiencies, as outlined by Alkire and Foster (2011b) and Batana and Duclos (2008).

When many dimensions are included, distributional data are displayed as a *n x d* matrix of accomplishments X^{nd}, where element x_{ij} represents the accomplishment of person I *(i=1,...,n)* in indicator *j (j=1,...d)*. x looks like this:

$$X = \{x_{11} \quad x_{i1}\, x_{n1}\, x_{1j} \quad x_{ij}\, x_{nj}\, x_{1d} \quad x_{id}\, x_{nd} \} \quad \text{.....(2.29)}$$

The Alkire and Foster (2011) methodology uses the counting approach in the identification step, making it the most axiomatically derived multidimensional poverty measure (Alkire & Santos, 2013a:240). For each employed indicator, a deprivation cut-off is established in counting methodologies to show the minimum normative level of achievement needed to be considered non-deprived (Alkire & Santos, 2013a:240). Let *z (z1,..,zd)* be a row of vector of dimension-specific thresholds *zj* (deprivation cut-offs). There is a distinct poverty line (zj) for each dimension to help identify those who are underprivileged in that area. The Alkire and Foster Methodology is versatile when it comes to the weights to be given to each indication,

allowing for equal or differing weights to be given to various dimensions depending on their relative relevance. They must then undergo a robustness test.

For clarity of the presentation, an example can be given where all dimensions are equally weighted (Batana & Duclos, 2008).

Assume that a matrix of deprivations

$x^{\sim 0}$ = [$x_{ij}^{\sim 0}$] is resulting from *x* as follows: for all *i* and *j*

$x^{\sim 0}$={1 $if\ x_{ij} < z_j$ 0 $if\ otherwise$ ……..….(2.30)

This indicates that when a person's achievement x_{ij} falls strictly below the established threshold z_j for a certain indicator, that person is considered to be deprived for that indicator. When each row is added up, a new column vector c of deprivation sums appears with c_i representing the number of deprivations experienced by individual *i.* This is the first cut-off, whereas the Alkire and Foster methodology is referred to as a "dual cut-off method of identification," which, as its name suggests, employs two different types of cut-off.

Let the identification function $\rho(x_{i,}\, z)$ be used for identifying those who are truly poor such that :

$\rho(x_{i,}\, z) =$ {1 $if\ individual\ is\ poor$ 0 $if\ otherwise$ ……(2.31)

Consider *k* to be the cut-off. An individual *i* is identified as poor when $\rho_{k,}(x_{i,}\, z)$ =1 or $c_i \geq k$. $\rho_{k,}(x_{i,}\, z)$ is the identification function corresponding to the threshold *k.* Therefore, equation (2.11) can be written as follows:

$\rho_{k,}(x_{i,}\, z)$ = ɓ ($c_i \geq k$) = {1 $if\ c_i \geq k$ 0 $if\ otherwise$ ……..(2.32)

Where ɓ ($c_i \geq k$) stands for the standard indicator function which can get the value 1 if the expression in brackets stands and the value 0 for otherwise.

In a multidimensional environment, a choice still needs to be made: who should be considered poor among individuals who fall below the threshold in one or more dimensions? How many k minimal deprivations must someone endure in order to be considered poor? The union approach is the beginning point, which classifies someone as multidimensionally impoverished if they fall short in just one dimension (k=1) (Atkinson, 2003:51). If the number of dimension d is high, this strategy might be overly inclusive and could exaggerate poverty (Alkire & Foster, 2007:8). In addition, a person may experience deprivation in one or more dimensions for reasons unrelated to opportunity (such as norms, preferences, and beliefs) (Basarir, 2009:5; Alkire & Santos, 2013a:242). A union method may not be effective in

identifying and assisting the most severely disadvantaged as a result. The UNDP's HPI, an index that measures poverty across three dimensions—health, education, and income—uses this strategy (Basarir, 2009:5).

The intersecting method, on the other hand, views a person as poor if they are poor across all dimensions (k=d) (Atkinson, 2003:51). Contrary to the union approach, this method of identification is too stringent and typically produces low estimates of poverty, but it is predicted to identify those who are most impoverished. It obviously ignores people who experience severe but not universal deprivation (i.e., a healthy homeless person). This could lead to the conclusion that someone who experiences numerous deprivations severely is not poor. According to Bresson (2009:2), Lugo and Maasoumi (2009:25), and other authors, the union and intersection criteria used to identify poverty appear to be too strict in most situations.

This demonstrates the need to establish a distinct number of dimensions k (cut-off) that a person must be deprived in order to be considered multidimensionally poor. The second cut-off k should be chosen to be any value between one (the union approach, k=1) to the greatest possible number of dimensions d (the intersection approach, k=d), according to the Alkire and Foster (2011b) measure. In other words, the identification point is between the two extremes, at a point between 1 and k and d. Thus, the Alkire and Foster methodology is referred to as "a dual cut-off method of identification" because it depends on both the indicators' cut-offs (z_j) and the poverty cut-off (k).

2.7.2.1.2 Aggregation

The key axioms of monotonicity and transfer are not satisfied by the head count ratio, according to Sen (1976:219) in his landmark article. The problem of monotonicity is addressed in a multidimensional environment where, for a poor person, a new deprivation in a previously non-deprived indicator should increase the overall level of poverty. Despite not satisfying the monotonicity, dimensional monotonicity, or deprivation severity criteria, H reflects the prevalence of poverty.

Take into account qk as the quantity of the poor identified using the cut-off k and the thresholds vector z. Thus, the following will be the headcount ratio H:

$$H = \frac{q_k}{n} \qquad \text{.....(2.33)}$$

Where $q_k = \sum_{i=1}^{n} \quad \rho_{k,}(x_{i,}\, z) = \sum_{i=1}^{n} \quad \text{ɓ}\,(\, c_i \geq k)$

The headcount ratio H is unaffected if a poor person experiences a deprivation in a new dimension. This suggests a breach of the assumption of dimensional monotonicity. According to the principle of dimensional monotonicity, if impoverished individual *i* experiences fresh

deprivation in a different dimension, this should raise the overall level of poverty. Furthermore, H cannot be dissected to show the contribution of each dimension to poverty (Alkire & Foster, 2011b:479). Alkire and Foster (2011b:479) made the decision to include information on the depth of the poor's plight in order to address these issues.

The *share of possible deprivations* suffered by a poor individual *i* is provided by:

$\underline{c}\,(k) = \frac{1}{d}\; c_i\; \rho_{k,}(x_{i,}\, z)$……..…(2.34)

while the *average deprivation share* across the poor will be given by:

$A = \frac{1}{q_k d}\sum_{i=1}^{n} \quad c_i \rho_{k,}(x_{i,}\, z)$ ……(2.35)

The *adjusted headcount ratio M0* indicates not only the incidence but also the breadth of poverty (Alkire & Foster, 2011b:479; 2011a:299; Alkire & Santos, 2013a:244; Alkire & Seth, 2009:12).

$M_0 = HA = \frac{1}{nd}\sum_{i=1}^{n} \quad c_i \rho_{k,}(x_{i,}\, z)$ ……..(2.36)

If an individual *i* experiences an additional dimension, it is obvious from the equation (2.16) that A will rise and that M_0 will as well. M_0 thus meets the requirements for dimensional monotonicity. When some indicators are strictly ordinal, categorical, or dichotomous, M_0 can be utilized (Alkire & Foster, 2011b:479; Alkire & Santos, 2013a:244). The majority of multidimensional techniques based on capabilities employ this type of data. There is no cardinal significance to the values of ordinal indicators. They are only listed according to birth order or self-reported health.

There is no one approach that can translate into cardinal distances across the various groups, according to Alkire and Santos (2013a:244). Although categorical indicators lack cardinal values, they can be grouped to demonstrate sufficiency or deprivation (such as water source, roof materials, sanitation facilities or occupational category). The M_0 measure integrates the indicators in a reliable manner by categorizing all the variables into deprived and non-deficient groups. The word "robust" in this context refers to the fact that the M_0 measure does not change when any of the indicators' scales are monotonically transformed, together with the appropriate deprivation threshold (Alkire & Santos, 2013a:244).

The M_0 does not employ any dimension-specific data on the depth of deprivation; it just measures the extent and intensity of poverty. As a result, it goes against the conventional monotonicity condition, which states that poverty should rise as a person becomes more deprived in any given dimension. When all indicators are represented by cardinal data, Alkire

and Foster (2011a:279) created a class of adjusted FGT measures that are sensitive to the degree of deprivation.

In this instance, a matrix $\hat{y}^1$ will be constructed deriving from $x^{\sim 0}$ by replacing 1 by the respective normalised gaps $g_{ij}^1 = \frac{z_j - x_{ij}}{z_j}$ for all cardinal data *j* and for all individual *i*. When *G* is considered as the average poverty gap across all cases in which poor individuals are deprived, then

$$G^1 = \frac{1}{\sum_{i=1}^{n} \quad c_i \rho_{k,}} \sum_{j=1}^{d} \quad \sum_{i=1}^{n} \quad g_{ij}^1 \rho_{k,}(x_{i,}\, z) \quad \text{.....(2.37)}$$

The *adjusted poverty gap M1,* which is described as the weighted average of indicator-specific poverty gaps, is therefore calculated as follows:

$$M_1 = HAG = \frac{1}{nd} \sum_{j=1}^{d} \quad \sum_{i=1}^{n} \quad g_{ij}^1 \rho_{k,}(x_{i,}\, z) \quad \text{.....(2.38)}$$

M_1 considers the degree of the deprivations that the poor experience in addition to their number. For instance, M_1 rises whenever a poor person experiences greater deprivation in a particular indication. Even though the person is still poor, poverty lessens if any indicator's shortfall from the deprivation criterion is reduced. The M_1 cannot, however, reflect any influence of an increase or decrease in the number of deprived people among the poor with respect to inequality among the poor.

Replacing *G* by *S* the severity of deprivations among the poor or the average squared poverty gap among the poor in equation (2.18), the measure obtained is the *adjusted squared poverty gap M2.*

$$S = \frac{1}{\sum_{i=1}^{n} \quad c_i \rho_{k,}} \sum_{j=1}^{d} \quad \sum_{i=1}^{n} \quad g_{ij}^2 \rho_{k,}(x_{i,}\, z) \quad \text{.....(2.39)}$$

Then $M_2 = HAS = \frac{1}{nd} \sum_{j=1}^{d} \quad \sum_{i=1}^{n} \quad g_{ij}^2 \rho_{k,}(x_{i,}\, z)$ .....(2.40)

The adjusted squared poverty gap M_2 metric is sensitive to the number, depth, and inequality of deprived conditions that the poor experience.

This class of Alkire and Foster's multidimensional poverty measures demonstrates a tendency that may be summed up as the adjusted FGT class of multidimensional poverty measures as M_α

$$M_\alpha = \frac{1}{nd} \sum_{j=1}^{d} \quad \sum_{i=1}^{n} \quad g_{ij}^{\alpha} \rho_{k,}(x_{i,}\, z) \quad \text{with } \alpha \geq 0 \text{.....(2.41)}$$

Where α=0 for M0 the adjusted headcount ratio, α=1 in the case of M1 adjusted poverty gap and α=2 in the case of M2 the adjusted squared poverty gap.

2.7.2.1.3 The weights

How to allocate weight to various characteristics is a crucial difficulty in multidimensional poverty measurement, in addition to identification and aggregation. The corresponding importance of the various deprivations is depicted using the weights or deprivation values. A standard scenario where all weights are one and add to the number of dimensions results from assigning equal weight to all deprivations based on their assessed importance. In numerous other situations, some dimensions are deemed to be more significant than others and are given a disproportionately higher weight. A vector whose elements add up to d but might vary from one, with higher weights signifying greater importance, illustrates this case. The deprivation values have an impact on how the poor are identified since they define the minimal set of deprivations required to label a person as poor. Where the proportional contributions of deprivations to overall poverty varies, the aggregation step is also impacted (Alkire & Foster, 2011a:295-296).

2.7.2.1.4 Limitations of the Alkire and Foster Methodology

The Alkire and Foster methodology for assessing multidimensional poverty provides a versatile framework that allows for the application of various identification criteria. This is done by counting the deprivations individuals experience, with a focus on those facing simultaneous or coupled deprivations. The Alkire and Foster parametric family of measures maintains several desirable qualities, such as subgroup decomposability and dimensional breakdown, without violating any of them. The computation is straightforward (Alkire & Santos, 2013a:246). Each measurement consists of intuitive partial indices, including the average poverty gap, average poverty intensity, and incidence of poverty (Alkire & Santos, 2013a:246). Beyond considering multiple indicators, the methodology quantifies poverty in a multidimensional manner by incorporating the shortcomings of each indicator into the calculation, recognizing each deprivation as "inherently undesirable" (Alkire & Foster, 2011b:478).

Addressing criticisms highlighted by Alkire and Foster (2011a) in their article titled "Understandings and Misunderstandings of Multidimensional Poverty Measurement," many of the alleged shortcomings of their approach were identified as misunderstandings. Contrary to a complaint that the methodology does not enhance marginal data arrays, it is clarified that although it loses some information during the identification stage by producing a single overall number based on simultaneous deprivations, the unique contribution of each indicator is represented by consistent partial indices. These partial indices also indicate the extent to which the headcount ratio contributes to the overall number. It is acknowledged that the overall figure is sensitive to weights. However, robustness tests conducted on studies using the same

technique (Alkire & Santos 2010, 2013b; Alkire et al., 2010) did not support this criticism in empirical findings.

- The Alkire and Foster methodology is not superior to marginal data arrays in terms of value. However, by generating a single overall number during the identification step, which is based on the experience of simultaneous deprivations, it does lose information.
- The primary innovation is that the total number is connected to a collection of reliable partial indices that show the relative contributions of each indicator, the sum of contributions, and the headcount ratio;
- It reacts to weights too quickly. The robustness analyses of the studies that employed the same technique, however, did not support this critique (Alkire & Santos 2010, 2013b; Alkire *et al*., 2010); and
- The condition that indicators be accessible for the same home is excessively demanding. However, there is an increasing amount of data available on the household level, as evidenced by the numerous published studies and reports that employ this methodology.

2.7.2.1.5 Relation of Alkire and Foster Method and UNDP MPIs

The Alkire and Foster methodology serves as a foundational framework for measuring multidimensional poverty using various methods, allowing for flexibility in adjusting weights, poverty cut-offs, and measurements (Alkire & Foster, 2011a:306). This methodology is applicable at different levels, whether local or global (Alkire & Foster, 2011a:306).

The choice of measurements can vary; some may utilize cardinal data for representing M0 and the extent of poverty, while others may only have access to ordinal data characterizing M1 and the depth of poverty (M2). An example of the Alkire and Foster methodology is the Multidimensional Poverty Index (MPI), widely used in research (Alkire & Santos, 2010; Alkire & Santos, 2013b; Alkire et al., 2015; UNDP, 2010).

In the MPI, globally comparable data was utilized in Alkire and Santos' (2010) study to implement M0 for 109 developing nations (about (78%) of the world's population) based on 10 indicators. Poor individuals were identified based on the level of attainment of household members, with MPI cut-offs roughly correlated to global benchmarks, primarily the MDGs. The MPI shares three components with the Human Development Index (HDI): standard of living, health, and education. However, the MPI employs 10 factors to measure poverty, while the HDI uses only four.

In the MPI, indicators within each of the three dimensions are given equal weight. A household is deemed multidimensionally poor if the weighted sum of the indicators is (30%) or more of

the dimensions (Alkire & Santos, 2010:7). Despite their comparable size, the HDI and MPI differ significantly. The AF technique (and its example, the MPI) distinguishes the poor from the non-poor when measuring poverty and focuses solely on statistics related to the poor, excluding the non-poor (Alkire & Foster, 2011a:307).

The HDI, a welfare index based on three marginal distributions combining into one overall measure, was initially used in the Human Development Report (HDR) in 1990 (UNDP, 1990). The MPI provides a comprehensive understanding of the depth and breadth of deprived areas. The MPI was established by the UNDP in collaboration with the Oxford Poverty and Human Development Initiative (OPHI) to replace and improve upon the Human Poverty Index (HPI). Unlike the HPI, the MPI is capable of detecting overlapping deprivations.

In the MPI, each household has a unique profile of multidimensional poverty, breakable down by indicators, allowing for an exploration of the components contributing to multidimensional poverty among various population sub-groups or regions. This has practical implications for policies targeting the interlocking deprivations experienced by the poor, facilitating more effective targeting of vulnerable populations, assessment of program results, and tracking the development of MDGs.

Both the HDI and the HPI have faced criticism for not considering other dimensions and indicators endorsed by the MDGs or the human rights movement (Alkire & Santos, 2010:12). They are also noted for limitations in approach, data, and dimensionality. However, these indices paved the way for the development of other multidimensional measures, including poverty measurements.

2.7.2.2 Bourguignon-Chakravarty Poverty Measures (2003)

Uses a cross-sectional dimensional measure, which assigns values to poverty gaps within each dimension

$1/\theta\ ^{\alpha}BCh = \sum [(\sum_{j\in d} w_j x_{ij}) \quad]$, $\theta > 0$, $\alpha > 0$ ……(2.42)

Where:

x_{ij} Represents normalized poverty gap for dimension j for observation variable i w_j is the weight of dimension j.

θ is the parameter of the BCh function that measures the elasticity of substitution

α is the parameter of the BCh function.

Bourguignon-Chakravarty theoretical presentation is very crucial in developing poverty analysis for Harare province. The use of weighting is key as dimensions and indicators should be weighted in order to be objective in analysis.

2.7.2.3 Human Development Report (HDR)

Developed in the 1990s, the HDR represented a mega-shift from income poverty reliance for poverty measurements. “Human development is a process of enlarging people's choices. The most critical of these wide-ranging choices are to live a long and healthy life, to be educated and to have access to resources needed for a decent standard of living. Additional choices include political freedom, guaranteed human rights and personal self-respect. Human development thus concerns more than the formation of human capabilities, such as improved health or knowledge. It also concerns the use of these capabilities, be it for work, leisure or political and cultural activities” (HDR, 1990:1).

HDR report measured poverty on three aspects, which are:

- Income;
- Life expectancy; and
- Education (literacy).

From 2010, the HDR adopted the MPI and HDR was no longer used for poverty measurement but only to assess poverty and deprivations households face in respect to health, education and living standards (UNDP, 2010:93-95).

2.7.2.4 UNDP Multidimensional Poverty Index (UNDP MPI)

The UNDP MPI has undergone continuous enhancements in the Human Development Report (HDR) since 2010 under the efforts of Alkire and Santos. Until 2014, it was grounded in the Oxford Poverty and Human Development Initiative (OPHDI) (Dotter & Klasen, 2014). The introduction of the Sustainable Development Goals (SDGs) in 2015, coupled with ongoing improvements in survey questions for data on SDG indicators, contributed to the refinement of the UNDP MPI in 2018 (UN, 2015; Kovacevic, 2015). This aligns with the Third Decade on Poverty Reduction agenda (2018–2027) highlighted by Alkire and Jahan (2018).

The MPI is closely linked to the headcount method as it assesses the size of the population in poverty through weighted indicators. Comprising three dimensions, ten indicators, and associated weights, the UNDP MPI's details are outlined in Table 2.7.

Table 2.7: 2018 MPI- UNDP dimensions, indicators, deprivation cut off and weights

Dimension	**Indicator**	**Deprived if living in the household where**	**Weights**
Health	Nutrition	An adult <70years or undernourished child	1/6
	Child Mortality	Infant mortality in the family for the last 5 years	1/6
Education	Years of schooling	10yrs and above members in the family who finished six years of education	1/6
	School attendance	If any child dropout < 8^{th} class in the household	1/6
Standard of Living	Cooking fuel	Backward sources of cooking energy; cow dung, firewood, charcoal or coal.	1/18
	Sanitation	Poor household sanitation measured using SDG guidelines or sharing sanitation facilities	1/18
	Drinking Water	Unsafe sources of drinking water using SDG guidelines) or more than 30-minute round trip to fetch drinking water	1/18
	Electricity	Non electrified or lack access to electricity	1/18
	Housing	Inadequate roof, walls and floor; natural materials used for housing	1/18
	Assets	The household lacks more than 2 assets from given list of household assets such as; radio, computer, bicycle or car	1/18

Source: UNDP (2018)

Households are considered multidimensionally poor if they experience deprivation in at least one-third of the weighted indicators. The UNDP utilizes data from DHS, MICS, and national household surveys for the MPI, but inherent data constraints lead to missing data sets in some countries, necessitating the use of proxies (UNDP, 2014).

The UNDP MPI offers several advantages. It emphasizes a comprehensive conceptualization of poverty, integrating broader social and economic dimensions alongside economic growth. The measure combines monetary and human poverty aspects, providing policymakers with insights into both social and economic poverty at the country level. The user-friendly nature of the UNDP poverty measure allows for broad application by both experts and non-experts, mobilizing public support, donor financial aid, and government political will. It systematically tracks yearly progress in poverty alleviation, highlighting gaps for policymakers to address. Unlike money metric measures sensitive to market fluctuations, the UNDP measure remains stable (Mowafi, 2019).

However, the measure has drawbacks. It lacks a headcount threshold for individuals below a specific bound, limiting information for policymakers on resource mobilization against poverty. The MPI only provides a general incidence of poverty based on three dimensions and does not measure poverty inequality among the poor, contradicting Sen's criteria for a good measure. The (30%) cut-off aspect, intended to factor in inflation, is seen as a significant disadvantage. The method raises questions about profiling only three dimensions when poverty has many aspects not covered in the UNDP MPI. While simplicity is cited as a reason, there is concern that too few dimensions may overlook important causes of poverty. The UNDP MPI acknowledges system weaknesses, including data constraints leading to proxy use and the omission of factors like inequality among the poor and poverty intensity.

Despite imperfections, the UNDP poverty measure serves as a valuable tool for poverty evaluation throughout the development process. Suggestions for improvement include considering additional dimensions, such as powerlessness, deprivations of rights, violence, and time use, though data availability and disagreements on appropriate dimensions pose challenges (Dotter & Klasen, 2014). Alternatives like the Correlation Sensitive Poverty Index (CSPI) have been proposed, but they may not capture relationships between indicators, which is a key objective of poverty measurement (Rippin, 2011). Sen criticizes fixed lists of dimensions, advocating for public participation in determining what should be included and why (Sen, 2005:158).

2.7.3 Theories on the Measurement of digitalisation

Indeed, when considering digitalisation or ICTs from the perspective of the capacities approach, the multidimensionality of access becomes more evident. According to Sen (1999), Warschauer (2004), Pruulmaan-Vengerfeldt (2008) and Barrantes (2007b), having an asset or having access to certain utilities may not necessarily result in a person being happy. What a person can finally accomplish with an item (such as a computer) is what has value, and this is decided by the properties of the asset (such as typing), the person's traits (such as literacy or illiteracy), as well as external factors (e.g. power available or not). This closely resembles Rein's (1983) research, which came to the important conclusion that deprivation is not just the absence of resources but also the inability of individuals to acquire those resources.

These larger conceptions of poverty definitely take into account some of the traits of the digitally poor as outlined by Barrantes (2007a). These people include those who don't make enough money to afford ICT access, those who lack the bare minimum skills necessary to use ICTs, and finally those who don't have enough resources or reside in underdeveloped areas and are therefore deemed ineligible by service providers for the expansion of ICT infrastructure. Less clear is the connection between other aspects of digital poverty. Lack of demand for ICTs that results from a lack of a perceived need could be caused by a lack of options, a true dissatisfaction with the service, or something known as "information asymmetry." In other words, ICTs are not desired because people do not understand the potential applications for them. This may have a generational or gender component, as noted by Barrantes (2007b), but it may also be indirectly tied to economic disadvantage because the opportunity cost of getting the ICT service may be excessive in comparison to other demands.

Socioeconomic deprivation, as well as digital deprivation, typically have three dimensions: economic/financial, social/human, and natural/physical. Economic/financial deprivation includes income, expenditure, investment, and consumption. Social/human deprivation includes knowledge, access to basic social services, social social networking, and communication in times of emergency (infrastructure, natural resources, biodiversity).

By enhancing social or economic networking and communications, as well as by processing and disseminating information, promoting economic inclusion, lowering transaction costs, and fostering the development of social capital, ICTs can act as facilitating factors that link social, economic, and natural well-being. The poor have access to faster and more accurate market information, new manufacturing tactics and technologies, and regular communication with peers and other social and professional contacts and colleagues thanks to ICTs. Barrantes (2007) used the following framework as show in Figure 2.6 to describe the digital poverty levels which a person may have.

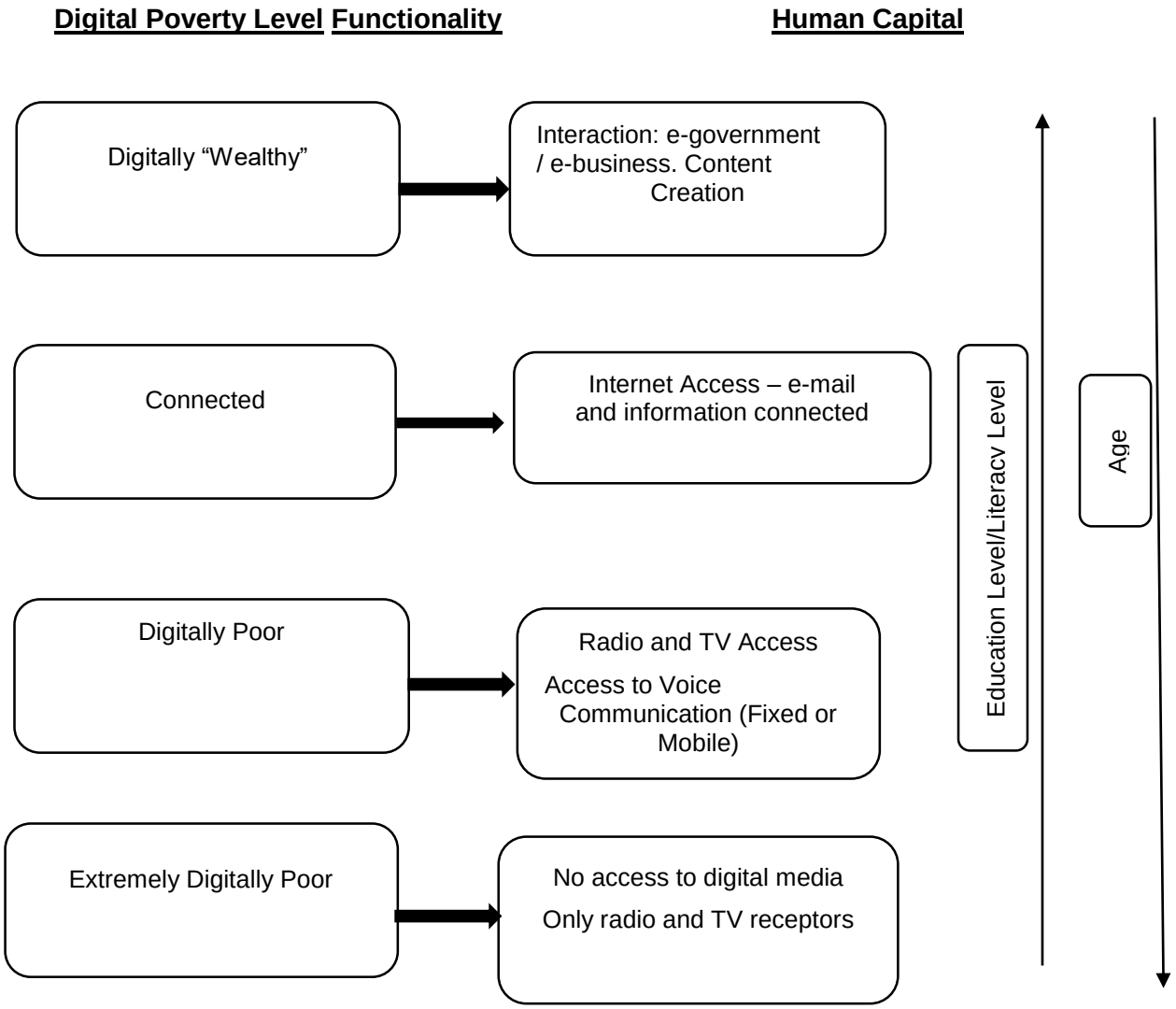

Figure 2.6: Digital Poverty Levels

Source: Barrantes (2007)

2.8 CHAPTER CONCLUSION

This chapter focused on the theoretical aspects of digitalisation and poverty, trailing from the definitions as provided by various authors, such as Sen (1978) and Laderchi *et al* (2003) to theories on the measurements of unidimensions of poverty, multidimensions of poverty and digitalisation. Unidimensional poverty was elaborated upon as much as multidimensional poverty. Alkire and Foster (2011b) methodology to be utilised in this study was expanded as much as digitalisation poverty. The theoretical literature majored on the detail about poverty and digitalisation that has been authored in the past. Schumpeter (1911) pioneered the work on innovation and its possibility of alleviating poverty. The work by Schumpeter (1911) was further amplified by Sen (1976) and a tangible aspect on multidimensional poverty was later supported by Sen (1976), Sen, Shorrocks and Thon (1983), as well as Foster, Greer and

Thormbeck. (1984). Lardechi *et al.* (2003) did put the idea of multidimensional poverty, only to be supported by Dunga (2021).

Feagin *et al.* (1972)'s perception of poverty exhumed in the theoretical literature is a theoretical aspect that will assist in putting the groundwork for perceptions of digital poverty in this study. The measures of poverty in the form of unidimensional and multidimensional measures were discussed. The Alkire and Foster (2011) measure of multidimensional poverty and Barrantes (2007)'s digitalisation poverty measure were of great potency, as they are the ones to be utilised in addressing the core-objective, which is to investigate the relationship between digitalisation and multidimensions of poverty. The unidirectional poverty indices such as severity poverty index and Sen Index, amongst others, are equally useful in espousing monetary approaches to poverty measures. This research is focused on analysing the relationship between multidimension of poverty and digitalisation and this accumulation of literature fathomed the related past literature.

CHAPTER 3: EMPIRICAL OVERVIEW OF POVERTY AND DIGITALISATION

3.1 INTRODUCTION

This chapter provides an empirical overview of the core concept, which is the relationship between poverty and digitalisation. The chapter commences by engaging a panorama of poverty and digitalisation empirical study analysis across the world, in continents which include Asia, Europe, America and Africa. It is without saying that there is no sacred cow in terms of the wrath brought by poverty around the world, what may differ are the types, depth and impact. The chapter will present more detail on poverty in Africa and more specifically in Zimbabwe.

Zimbabwean poverty trends as documented by ZIMSTAT (2022) and the World Bank (2020) and national policy on digitalisation provide more empirical aspects of population trends in Zimbabwe, mortality rates, poverty country indicators, land use, health, education, employment and digitalisation highlights in Zimbabwe's ten provinces. The lack of empirical literature on the topic in Zimbabwe is augmented by analysing similar studies in Africa and the World, which brings the debate to life. Such interesting empirical research includes Yılmaz *et al.* (2018), Ma *et al.* (2018), David (2019), Martinez (2020), Alimi and Okunade (2020), Akinboade *et al.* (2021), Yang *et al.* (2021), Mateko (2022), Olamide *et al.* (2022), amongst other. The gaps in empirical literature will be discussed and a conclusion to the chapter will wrap up.

3.2 GLOBAL OVERVIEW OF DIGITALISATION AND POVERTY

The topic of this discussion is contextualized as the relationship between digitalisation and poverty, and an overview will be presented globally with particular emphasis from a few chosen economies across several continents of Asia, Europe and Africa, then lastly more discussions in relation to Zimbabwe. The premise for exploring the empirical aspects from all over the world is to establish the consistency and validity of the poverty concern in order to provide answers to a specific research topic or analyse the already answered research topics similar to the current discourse. Rather than drawing information from theories or beliefs, empirical research relies on observations and measurements to arrive at conclusions. The empirical review across the world will provide limits and establish gaps.

3.2.1 Asian Context

China implemented a program to enhance their capability for eradicating poverty through ICT (Yanfeng & Qingjie, 2019). The program's goal was to ensure that poverty was relieved by specifically designed ICT tactics that enhanced information dissemination, internet coverage and e-commerce activity promotion, which lowered poverty levels in China (Yanfeng & Qingjie, 2019: 44). China is one of the countries with huge investments in ICT and its drive has been to eradicate poverty through ICT.

Indonesia had over 109 million internet users and a high incidence of corruption in 2019 (Sabani, Farah & Sari Dewi, 2019:3). High levels of corruption mean that resources are being diverted away from their intended usage. When resources designed to help the majority are stolen, corruption encourages high levels of poverty (Nur-tegin & Jakee, 2020:2). According to studies, the adoption of e-governance in Indonesia contributed to a drop in corruption (Sabani, Farah & Sari Dewi, 2019:7). Investments in digitalisation, especially e-governance, aids in the battle against poverty and corruption. Even though certain African nations like South Africa are utilizing e-governance, these systems still have significant difficulties running effectively in these nations (Meyer, 2019:6)

As an Asian nation, Indonesia benefits from ICT projects like e-governance in lowering corruption and raising living conditions. The quest of the researcher is to have Zimbabwe utilise technology in the same way that Indonesia did in order to reduce corruption through the use of technology. It is possible for Zimbabwe to take advantage of these advantages through digitalisation and thereby lower its levels of corruption, as well as combat poverty at the same time.

Ali and Singh (2017) investigated the impact of ICT on economic growth in India and identified a positive correlation between ICT and economic development. This suggests that ICT has played a constructive role in fostering economic growth in the Indian economy. The study highlights ICT as a crucial mechanism facilitating online goods sales, attracting new clients, increasing sales, and ultimately contributing to economic growth (Ali & Singh, 2017). The significance of e-commerce for businesses in India is emphasized, with the caveat that for the economic growth benefits of ICT to be substantial, consumers must possess internet access and e-buying skills. This underscores the importance of educating consumers on effectively utilizing ICT to enhance economic growth.

In a study by Halili and Sulaiman (2019) focusing on Indonesia, the researchers explored the factors influencing ICT acceptance among rural students for educational purposes. Data were collected through questionnaires, revealing that students in rural areas expressed a strong

demand for increased ICT usage to enhance academic performance and develop ICT skills (Halili & Sulaiman, 2019:5). However, the main challenges faced by many rural students included a lack of internet access, a shortage of ICT experts, and inadequate ICT infrastructure (Halili & Sulaiman, 2019). The study underscores the multifaceted nature of poverty, with access to quality education being a crucial aspect.

3.2.2 European Context

According to Nevado-Pea, López-Ruiz and Alfaro-Navarro (2019:3), high ICT usage is positively connected with a high quality of life in Europe. Therefore, it follows that poor ICT usage and low quality of life are associated. Although determining the level of low quality of life would be a monumental undertaking, it can be argued that poverty is frequently a contributing factor (Nadimi *et al.*, 2017). Germany and Slovakia are two other nations in central Europe whose economies benefit from extensive ICT use (Becker, 2018:9). Their significant digitalisation investment has resulted in higher production. Figure 3.1 below shows how the European Union countries' development of value added for the ICT sector has grown in manufacturing, increasing by (27%) over six years, while in services increasing by (41.7%) over the same period.

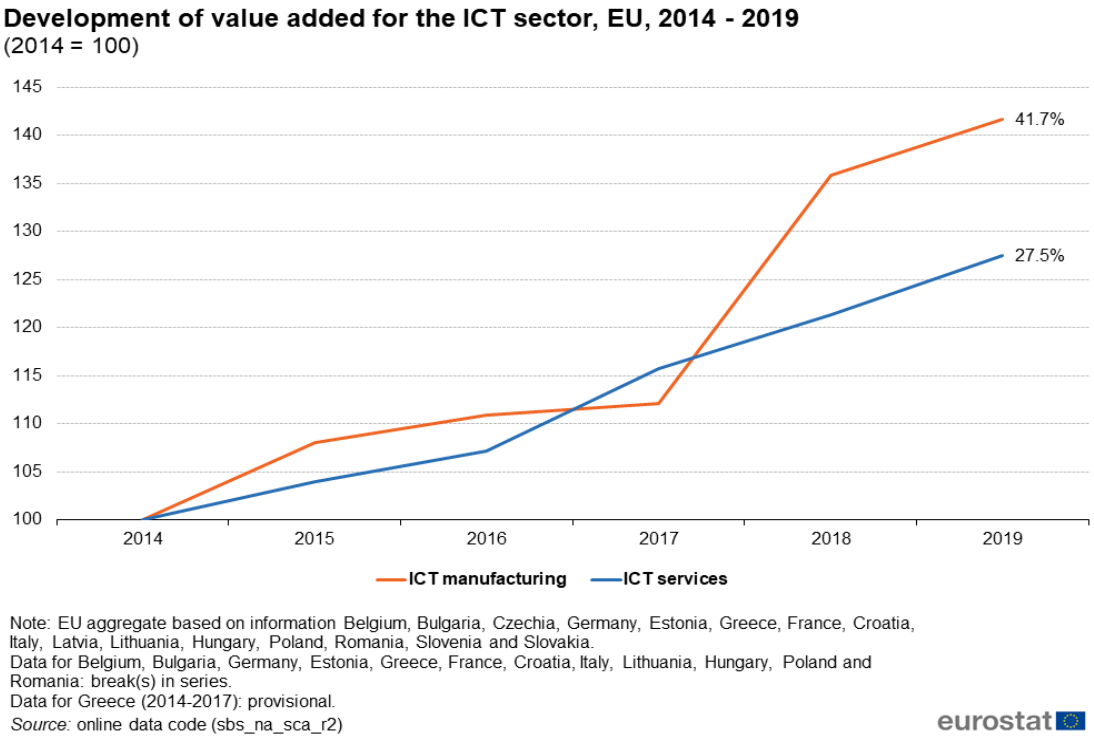

Figure 3.1: ICT Usage in Europe

Source: Eurostat (2020)

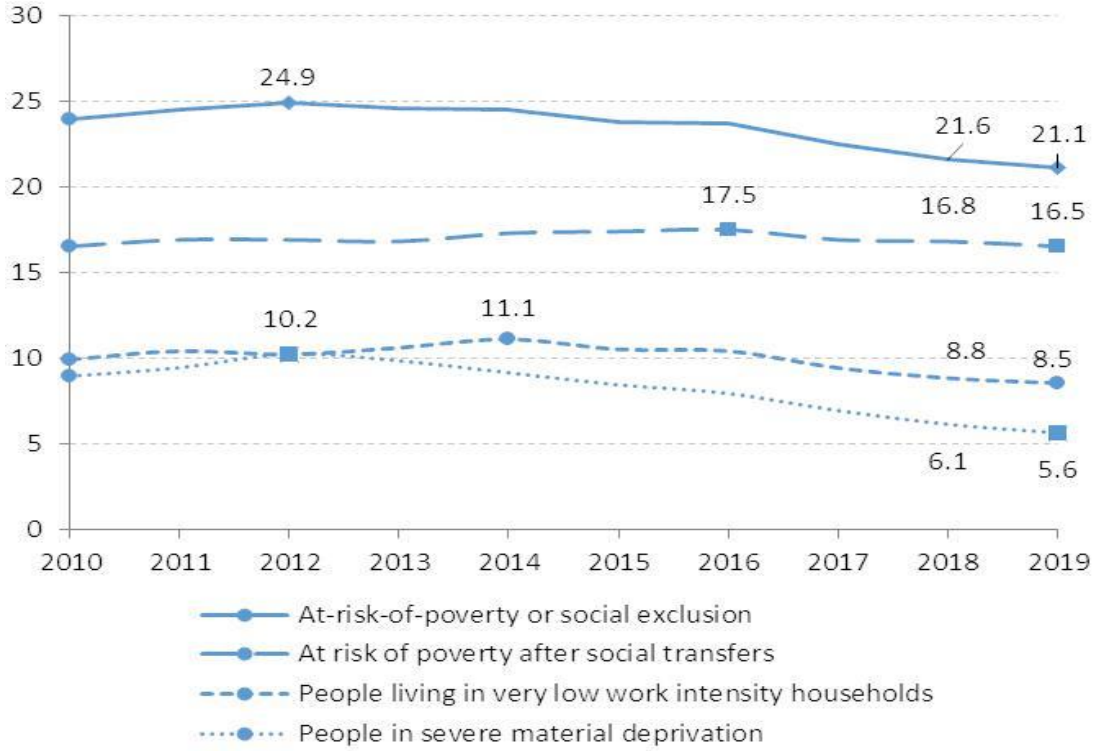

Figure 3.2: Poverty levels in Europe

Source: European Commission (2020)

Figures 3.1 and 3.2 clearly show why it remains a concern to heavily increase investment in ICT, when the poverty levels are not dissipating at the same rate, or marginally as shown above.

Augere-Granier (2017) conducted an investigation into rural poverty within the European Union, revealing that approximately 119 million European citizens, constituting nearly a quarter of the EU population, were at risk of poverty and social exclusion. The study provided recommendations suggesting that member states and regions could utilize EU funding to implement measures. While these measures may not directly target poverty reduction, they have the potential to address underlying factors contributing to poverty. Such measures include promoting job creation, improving services, developing information and communications technologies (ICT) infrastructure, and enhancing access to education.

Postula et al. (2021) delved into the impact of ICTs on energy poverty and unemployment in selected EU countries. The underlying hypothesis of Postula *et al.* (2021) was to explore whether the rapid development of ICT in EU countries might lead to increased unemployment, consequently resulting in higher levels of energy poverty. This is because access to energy is crucial for enhancing the quality of life and plays a pivotal role in economic development. The

study's results indicated that the use of ICT had a limited impact on the unemployment rate in the EU but significantly contributed to reducing the level of energy poverty in EU Member States.

ICT's impact on economic development is the subject of conflicting study perspectives from Toader *et al.* (2018) and Oshota (2019). This can be related to variations in how ICT is used and how widely it is adopted across various nations. The study conducted by Toader *et al.* (2018) concentrated on European economies. These nations typically have higher ICT penetration rates than Nigeria, which explains the differences between the findings of the two studies. This study demonstrated the potential of ICT as a tool for reducing poverty, and its application in various economic areas. Entrepreneurs in the manufacturing, service and banking sectors can all benefit from ICT.

3.2.3 American Context

Garcia (2019) investigated Mexico's economic development and ICT. The study's major objective was to look into the impact of ICT on Mexico. The study, which used quantitative research techniques, discovered a link between the use of mobile phones and economic expansion (Garcia, 2019:19). The results indicated that the GDP would expand more rapidly as mobile phone usage increased. When more individuals have access to mobile phones, commercial and manufacturing operations are boosted by this efficient form of communication, thus this is economically justifiable (Garcia, 2019). When people are in a situation of digital poverty, they are lacking in ICT skills. This indicates that addressing digital poverty is necessary for reducing poverty in all its manifestations. When a person lacks the ICT skills necessary for access to all types of information, they are said to be in a state of digital poverty (Cáceres, 2007).

Li (2022) investigated COVID-19 and the digital divide in America. The study examined the relationship between digital access and COVID-19 outcomes in U.S. counties and discussed the ways in which digital exclusion can exacerbate the pandemic's effects. By January 2022, vaccination rates had decreased, and COVID-19 case and mortality rates had increased in counties with increasing percentages of digitally excluded. The results of Li (2022) pointed to the fact that lack of access to the internet and digital technologies could exacerbate the impacts of the COVID-19 pandemic through multiple pathways, which could result in fatality. U.S. counties with lower levels of home Internet or computer access are seeing higher COVID-19 case and death rates. Limited access to broadband Internet is associated with slower vaccination rollout initially and lower vaccination rates overall. Health is one of the dimensions

of poverty under the UNDP MPI, which stipulates that if one is digitally excluded, one will be digitally poor, which is a serious problem.

3.2.4 African Context

Digitalisation, also known as ICT in this context, may be incorporated into a variety of economic sectors to reduce poverty. Low levels of education and potential illiteracy concerns are all aspects of poverty. ICT is viewed as a helpful tool for converting traditional classroom practices into a virtual learning environment (Aftab & Ismail, 2015:24). The increased adoption of digitalisation in Rwanda has raised literacy rates, as argued by Aftab and Ismail (2015). As a result, there is less information asymmetry about the options that could change someone's life as more individuals get educated. People are made aware of employment opportunities, raising their standard of living and lowering poverty. In the Southern African Development Community, ICT is viewed as a helpful instrument for expanding access to international markets (Mogotlhwane, Talib & Mokwena, 2011:61). However, there is no conclusive research on how ICT can be used to fight poverty. This study aims to close that gap.

Productivity depends on having access to reliable knowledge about how to conduct business in the modern era. However, several South African SME players are unaware of the advantages of utilizing digitalisation in their enterprises (Motlhanke, 2019:7). This creates a barrier to digitalisation investment and makes the fight against poverty more challenging. ICT adoption and usage could be improved with government financing and training support, which has been effective for SMEs in Botswana (Chube, 2015:64).

However, a number of African nations run on extremely tight budgets. The amount of money given for ICT initiatives may be little, which restricts ICT investment and the benefits that can be reaped from it. Examining transmission mechanisms that can be used to channel ICT in poverty alleviation is crucial given the current situation. According to Stoeffler *et al.* (2016), Africa is thought to be the most corrupt continent in the world as it was made obvious in Chapter 1 that poverty levels are very high in Africa.

Low digitalisation adoption rates in Sub-Saharan African nations are primarily due to inadequate digitalisation policy execution, while some digitalisation policies may have a negative impact on the costs of ICT-related goods. For instance, 1 GB of data costs twice as much in South Africa as it does in other nearby nations (Gillwald, Mothobi & Rademan, 2018:112). This suggests that those who cannot afford the data are not entitled to the advantages of using ICT-related facilities. This might encourage such people to fall into poverty.

Sound digitalisation policies, however, cannot be viewed as essential and sufficient conditions for economic growth and the reduction of poverty, but they do play a significant role in promoting economic growth and assisting in the reduction of poverty levels (Bohlin, Hanafizadez & Vu, 2017).

Karakara and Osabuohien (2019) looked into the need for banking and digitalisation services in West Africa. The results of their study demonstrated how socioeconomic variables, including income, age, gender and levels of education, affected the spread of digitalisation in West Africa (Karakara & Osabuohien, 2019:2). In comparison to Burkina Faso, the authors discovered that families led by women in Ghana had a reduced demand for financial services (Karakara & Osabuohien, 2019:9).

The aforementioned research results highlight the need for information sharing on financial services. Banking services might be beneficial to persons who are poor since they facilitate certain remittances from family members who live abroad. Those who lack access to banking could suffer as a result. Remittances cannot be seen as a cure for poverty reduction, but it should be acknowledged, although research has proved their value in doing so (Ogunniyi *et al*., 2020). Even if they may not be long-term solutions to poverty, remittances are nonetheless useful.

In Sub-Saharan Africa, government assistance is still necessary for digitalisation programs and policies. This assistance can take the shape of sensible digitalisation policies, market openings, and a decline in ICT sector monopolies. Digitalisation's contribution to the elimination of poverty and inequality in both high- and low-income nations was studied by Mushtaq and Bruneau (2019). According to Mustaq and Bruneau's study, digitalisation has a significant impact on economic growth and has helped to eliminate poverty and inequality as more goods and services were generated. This study demonstrates how information and communication technologies can help to reduce poverty.

The study by Mushtaq and Bruneau (2019) provides important insights, including the possibility of achieving digital finance through the use of digitalisation technology, which can aid marginalized groups. Therefore, having access to e-financial services aids in reducing poverty. However, this is only possible if the government provides the greatest amount of assistance and permits some level of competition amongst the digital firms. Government control is essential in preventing the establishment of monopolies, but there must also be space for a healthy amount of competition. This makes it possible for economies to profit completely from digital investment.

3.3 PROFILING ZIMBABWE

The HDI summarises three key factors of human development: a long and healthy life, access to information, and a fair standard of living. According to ZIMSTAT (2020), life expectancy is a measure of a long and healthy life. The expected years of schooling for children of school-entry age are the total number of years of schooling that a child of school-entry age can expect to obtain if present patterns of age-specific enrolment rates remain stable throughout the year. The level of knowledge is gauged by the mean years of schooling within the adult population. This represents the average number of years of education attained throughout the lifetime by individuals aged 25 years and older. Additionally, the standard of living is assessed through Gross National Income (GNI) per capita, denominated in constant 2017 foreign dollars, and converted using purchasing power parity (PPP) conversion rates.

The HDI is primarily based on international data from the United Nations Population Division (life expectancy data), the United Nations Educational, Scientific and Cultural Organization Institute for Statistics (mean years of schooling and expected years of schooling data), and the World Bank in order to ensure as much cross-country comparability as possible (the GNI per capita data). As mentioned in the introduction, due to various adjustments to the component indicators, the HDI values and rankings in this year's study are not comparable to those in previous publications. The 2020 Human Development Report includes recalculated HDIs from 1990 to 2019 utilizing a consistent series of data to enable evaluation of HDI progress.

Zimbabwe ranks 150 out of 189 countries and territories with an HDI value of 0.571, placing it in the medium human development category. Zimbabwe's HDI rating increased from 0.478 to 0.571 between 1990 and 2019, a (19.5%) increase. Table 3.1 summarizes Zimbabwe's development for each HDI indicator. Zimbabwe's life-expectancy at birth increased by 3.4 years between 1990 and 2019, the mean number of years spent in education climbed by 3.9 years, and the predicted number of years spent in school increased by 1.2 years. Between 1990 and 2019, Zimbabwe's GNI per person increased by almost (42.8%) .

Table 3.1: UNDP Report on Zimbabwe

Year	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita (2017 PPP$)	HDI value
1990	58.1	9.8	4.5	1,866	0.478
1995	50.5	9.8	5.5	1,782	0.453
2000	44.6	9.8	6.5	1,717	0.430
2005	43.2	9.5	6.8	1,384	0.411
2010	50.6	10.1	7.3	2,016	0.482
2015	59.5	10.3	8.2	2,658	0.553
2016	60.3	10.4	8.3	2,681	0.558
2017	60.8	10.5	8.3	2,759	0.563
2018	61.2	10.5	8.4	2,942	0.569
2019	61.5	11.0	8.5	2,666	0.571

Source: UNDP Report (2020)

The 2019 HDI for Zimbabwe is 0.571, which is higher than the Sub-Saharan African average of 0.547 and below the average of 0.631 for nations in the medium human development group. Zimbabwe is compared to Kenya and Lesotho from Sub-Saharan Africa, which have HDIs of 143 and 165 respectively, refer to Table 3.2.

Table 3.2: UNDP Report in Sub-Saharan Africa

Country	HDI value	HDI rank	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita (2017 PPP US$)
Zimbabwe	0.571	150	61.5	11.0	8.5	2,666
Kenya	0.601	143	66.7	11.3	6.6	4,244
Lesotho	0.527	165	54.3	11.3	6.5	3,151
Sub-Saharan Africa	0.547	—	61.5	10.1	5.8	3,686
Medium HDI	0.631	—	69.3	11.5	6.3	6,153

Source: UNDP Report (2020)

3.3.1 MPI Trends in Zimbabwe

The MPI, which detects several overlapping deprivations experienced by individuals in three dimensions—health, education and standard of living—was introduced in the 2010 Human Development Report. While the standard of living component is based on six factors, the health and education dimensions each include two indicators. The same home survey is used to collect all the data necessary to create a country's MPI. Each participant in the survey had their own deprivation scores, calculated after the indicators are weighted to get a deprivation score. To differentiate between the poor and non-poor, a deprivation score of (33.3%) (or one-third of the weighted indicators) is used. The home (and everyone in it) is categorized as multidimensionally poor if the deprivation score is (33.3%) or higher. Vulnerability to multidimensional poverty is defined as having a deprivation score more than or equal to (20%) but less than (33.3%). Finally, people who have a deprivation score of more than or equal to (50%) experience extreme multidimensional poverty.

For Zimbabwe's MPI estimation, the most recent survey data that were made accessible to the public date back to 2019. In Zimbabwe, there are 3.725 thousand persons who are categorized as multidimensionally poor and another (25.8%) who are vulnerable to multidimensional poverty (3,802 thousand people). The average deprivation score felt by those living in multidimensional poverty in Zimbabwe is (42.6%), which is known as the breadth of deprivation (intensity). The MPI, which measures the proportion of the population who are multidimensionally poor after adjusting for deprivation severity, is 0.110. The MPIs for Kenya and Lesotho are 0.178 and 0.084 respectively.

Table 3.3 contrasts income poverty with multidimensional poverty, which is determined by the proportion of the population that lives on less than US$1.90 per day (2011 PPP). Income poverty only tells a portion of the picture, as evidenced by this. The headcount for multidimensional poverty is (8.1%) lower than the headcount for income poverty. This suggests that those who are below the poverty threshold may have access to resources that are not financial. Table 3.3 also displays the proportion of Zimbabweans who are living in extreme multidimensional poverty. A complete picture of persons living in multidimensional poverty in Zimbabwe is provided by the contributions of deprivations in each dimension to overall poverty. Table 3.3 also includes data for Kenya and Lesotho for comparison.

Table 3.3: Contributions of deprivations in each dimension

Country	Survey year	MPI value	Headcount (%)	Intensity of deprivations (%)	Population share (%)			Contribution to overall poverty of deprivations in (%)		
					Vulnerable to multidimensional poverty	In severe multidimensional poverty	Below income poverty line	Health	Education	Standard of living
Zimbabwe	2019	0.110	25.8	42.6	26.3	6.8	33.9	23.6	17.3	59.2
Kenya	2014	0.178	38.7	46.0	34.9	13.3	36.8	24.9	14.6	60.5
Lesotho	2018	0.084	19.6	43.0	28.6	5.0	26.9	21.9	18.1	60.0
Sub-Saharan Africa	-	0.299	55.0	54.3	17.9	32.9	45.7	22.4	29.3	48.4

Source: UNDP Report (2020)

3.3.2 National Policy on Digitalisation (ICT) in Zimbabwe

Due to the rapid advancement of technology, the development and implementation of Information and Communication Technologies (ICTs) since Independence in 1980 have undergone extraordinary transformations. This development was made possible by the Government of Zimbabwe's recognition of the indispensable nature of ICTs, which sparked the creation of the first National ICT Policy, completed in 2005.

In order to prevent the country from falling behind, this second policy on ICT was crafted in 2012, which recognized the dynamism in the ICT sector, and makes periodic policy reviews necessary. Through the Ministry of Information Communication Technology, Postal and Courier Services (Ministry of ICTPCS), the government reviewed the first ICT Policy from mid-July to mid-September 2012 with financial and technical assistance from the National Economic Consultative Forum (NECF) and the United Nations Economic Commission for Africa (UNECA).

The Ministerial Vision was examined in the policy as it develops from the National Vision. The Ministerial Vision and Mission are included in this Policy due to their significance in establishing a solid basis for this policy.

The consultative process took note of the impressive advancements in the telecommunications sector as well as the barriers to further expansion of the ICT sector. Major obstacles to the development of the ICT sector include inadequate institutional structures, inadequate ICT infrastructure, and inadequate ICT skills.

The policy framework's overarching goals were:

- To facilitate the achievement of Zim-ASSET and other national development objectives.
- Growth: Facilitate increased access to telecommunications and information technology (ICT) across all facets of life, including e-Government, e-Commerce, e-Employment, ICT in education, ICT in health, ICT in science, and ICT in agriculture. Inclusiveness: Reduce the digital divide by making broadband available to everyone.
- Sustainability: Address issues brought on by the growth of telecommunications and ICT.
- Leading, enhancing and adjusting to the evolving telecommunications and information and communications technology environment.

The provision of key implementation programs on particular projects is essential to getting the intended results. The policy looks at topics including research and development, gender, and other marginalized groups, as well as capacity building and content creation. The realization that these concerns must be addressed by government together with the coordinated efforts of other actors brings financial and material resource issues to the forefront as well. It is urged that participants from all economic sectors take part in the execution of this policy framework. and adjust to the shifting ICT/telecom environment.

This 2012 ICT policy was further reviewed to formulate the current state of the institutional processes and the regulatory framework that is currently in place. It is hoped that, provided the various participants perform their assigned roles with diligence, Zimbabwe will realize its stated goal of being a unified, strong, democratic, prosperous and egalitarian society with a good standard of living for all by the year 2020.

The current ICT policy in Zimbabwe, which is coined the Zimbabwe National Policy on ICT, was endorsed by the Cabinet of Zimbabwe in 2016. The document recognized that ICT was inevitable in the livelihood of the people.

The ICT policy in Zimbabwe has resulted in a shrinking of the digital divide as well as an increase in mobile penetration of (95.4%) and internet penetration by 2020. The effects of an upsurge in electronic services have seen easier ways of communicating and conducting

business between people, between businesses and between people and businesses. Ngara (2019) agrees that there is an increase in the usage of WhatsApp, Facebook, twitter, YouTube and Skype in Zimbabwe.

The premise of the agenda is unique and forward going. However, the question which one may bring to the table is how effective the policy is in addressing digital deprivation in the country. The other request is to understand the extent that has the policy been implemented, and to what extent it has reached the rural and marginalized elements of society.

3.3.3 Geo-Political and Demographic Space of Zimbabwe

Zimbabwe is a transcontinental nation in Southern Africa that spans a total size of 390,757.5 square kilometres. Geographically, it is located at 20 000 S and 30 000 E. Botswana to the west, Mozambique to the east, South Africa to the south, and Zambia to the north are Zimbabwe's four neighbours (Indexmundi, 2020; ZIMSTAT, 2022). The country has a population of 15, 178, 979 people living in it as of 2022 and an average of 4.0 people living in each family (ZIMSTAT, 2022). Zimbabwe's provincial and international borders are depicted on the map below in Figure 3.3.

Figure 3.3: Geographical map of Zimbabwe

Source: Google maps (2022)

Zimbabwe has ten provinces, with Harare serving as both the nation's capital and its economic centre, and Bulawayo is the second-largest city. The remaining eight provinces are primarily rural with some urban elements, whereas Harare and Bulawayo are primarily urban centres (ZIMSTAT, 2022). Commercial farming (A2), small-scale farming (A1), resettlement, communal areas, national parks, sizable forests, and urban cities are the principal land uses in Zimbabwe.

The population distribution in Figure 3.4 shows that Mashonaland East, Mashonaland West, Midlands, Masvingo and Harare are highly populated provinces, contributing above (10%) of their population towards the national population figure (ZIMSTAT, 2022). However, household size distribution is somewhat even across all provinces at plus or minus 4.0.

Table 3.4 indicates provincial statistics in terms of gender, total populations per province as well as percentage total population against total national population. The total population of

Zimbabwe is 15, 178, 979 as of 2022, with a majority of the population being found in Harare which has (16%) of the total population, followed by Manicaland with (13%) and then Mashonaland West and Midlands with (12%) a piece. The lowest population is found in Bulawayo which has (4%) of the total population.

Table 3.4: Population per Province (Zimbabwe)

Province	**Male**	**Female**	**Total**	**% of Total Prov/Total National**
Bulawayo	307,983	357,957	665,940	4%
Manicaland	965,532	1,072,230	2,037,762	13%
Mashonaland Central	681,313	703,578	1,384,891	9%
Mashonaland East	835,264	895,917	1,731,181	11%
Mashonaland West	934,821	958,757	1,893,578	12%
Matebeleland North	400,188	427,438	827,626	5%
Matebeleland South	370,713	389,632	760,345	5%
Midlands	870,664	941,244	1,811,908	12%
Masvingo	763,537	875,002	1,638,539	11%
Harare	1,159,543	1,267,666	2,427,209	16%
Totals	**7,289,558**	**7,889,421**	**15,178,979**	**100%**

Source: ZIMSTAT (2022)

3.3.4 Population Growth in Zimbabwe

Figure 3.4 also shows how populations are growing in Zimbabwe as purported by the national census. The highest population growth is much pronounced in all provinces, except in Bulawayo alone. The marginal increases have resulted in the total change in population from 13.6 million people being recorded in 2012 to 15 million people being recorded in 2022 in Zimbabwe, which transforms to a (1.1%) increase in population (ZIMSTAT, 2022). The interesting question will be, did this corresponding increase in populations align to increases in the wealth, gross domestic product, and wellbeing of the people of Zimbabwe? The preceding query will be, if Zimbabwe's resources were stagnant, what is the impact of such marginal increase in the populations. In the scope of poverty levels, what impact does this population growth leave the country at?

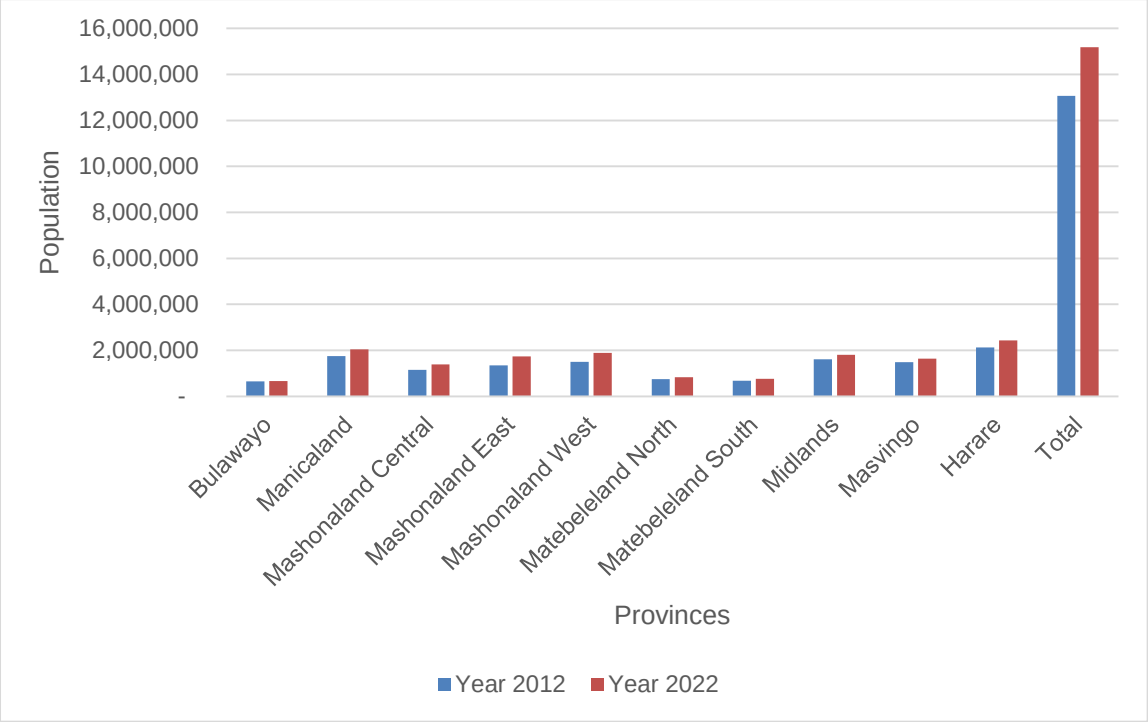

Figure 3.4: Population Growth in Zimbabwe

Source: ZIMSTAT (2020)

Population growth in the nation has averaged (2.27%) since 2009, as shown in Figure 3.4, and is ascribed to stable fertility (ZIMSTAT, 2018) and a consistent birth rate of (3.75%). (UN, 2019). This evidence has had a detrimental effect on employment and service delivery.

Zimbabwe is an agricultural nation, with (42%) of its land used for farming. Zimbabwe was the breadbasket of Southern Africa from the early 1990s until it gained independence from Britain in 1980. Including the rest of SADC, maize is farmed abundantly in Zimbabwe, although other grains like wheat, millet, and sorghum are also grown there. The most widely farmed tobacco kinds are Virginia Flue-Cured, Burley, and Oriental tobacco, collectively known as "Zimbabwe Golden Leaf." Cotton is the second-highest foreign currency earner among agricultural export crops, behind tobacco (ZIMSTAT, 2022).

3.3.5 Life Expectancy and Mortality Rate in Zimbabwe

Zimbabwe's life expectancy is predicted to be 60.8 years, and the child mortality rate (under 5 years old) has been declining since the 1960s, from a high of 151 to a value of 42.20 in 2018. (World Bank, 2020). The increase in prenatal and neonatal care in Zimbabwe was largely responsible for the (28.65%) decrease in child mortality. Prenatal treatment that meets high standards helps increase newborn survival rates (Makate & Makate, 2017).

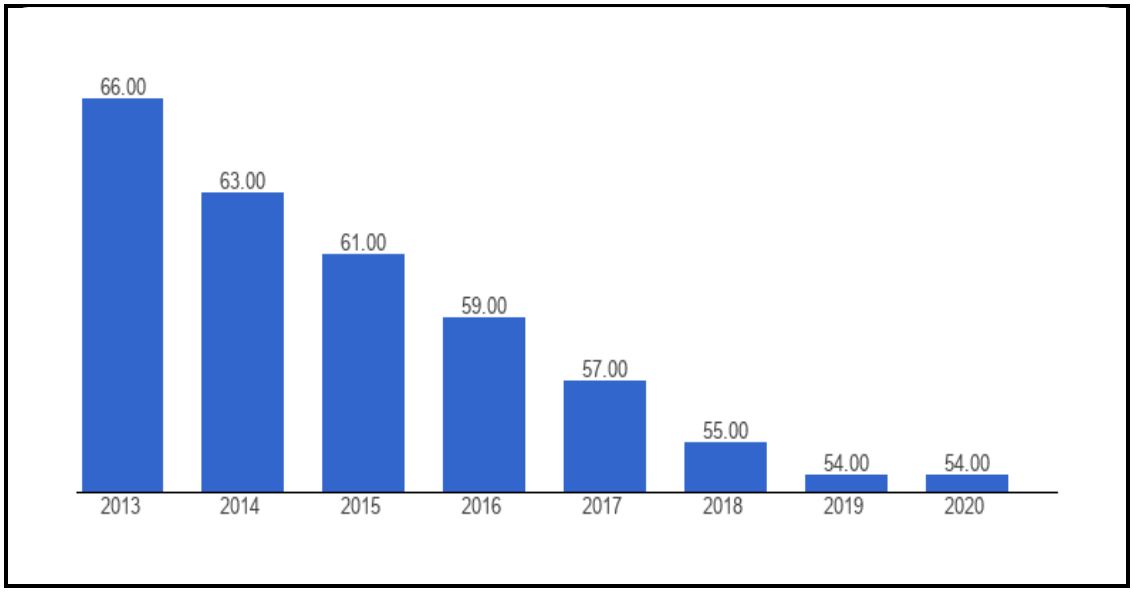

Figure 3.5 Mortality Rates in Zimbabwe

Source: The Global Economy (2020)

Figure 3.5 above shows that child mortality is decreasing per 1000 but remains slightly high (currently above 40 per 1000). The largest decrease in child mortality was recorded after 2010. Child mortality has a negative effect on population growth.

3.3.6 Country Indicator Values for Zimbabwe

Table 3.5 below, shows accepted country indicators in Zimbabwe.

Table 3.5 Country Poverty Indicators for Zimbabwe

Indicator Variable	**Value**
Skilled Labour force as a percentage of total labour	13%
Mobile phones subscription per 100	89.4%
Internet usage	27.10%
Gender Development Index (GDI) (index)	0.925
Inequality adjusted HDI (index)	0.435
GNI per capita	USD$2.661
Gross Capital Formation (% of GDP)	12.6%
Expected years of schooling	10.5 years
Carbon dioxide emissions per capita (tons)	0.7 tons
UNDP HDI (index)	0.56
UNDP MPI (index)	0.137

Source: UNDP (2020)

Zimbabwe has (27.10%) internet usage and (13%) skilled labor (UNDP, 2020). According to the table above, mobile phone usage in Zimbabwe is 89.4 per 100 people, and internet usage is 27.10. Zimbabwe's MPI and HDI are both 0.137 and 0.56, respectively (HDR, 2020; UNDP, 2020). The country of Zimbabwe emits 0.7 tonnes of carbon dioxide annually.

3.3.7 Arable land agricultural mode of production

ZIMSTAT (2018) indicated that Zimbabwe is a landlocked southern African country with a total land area of over 39 million hectares, with 33.3 million hectares used for agricultural purposes. However, of the 33 million hectares, only 4.3 million hectares of arable land is being utilised, which creates great concern over the underutilisation of land in Zimbabwe, which might be a source of poverty. Table 3.6 shows statistics of the breakdown of the arable land in Zimbabwe.

Table 3.6 Arable Land in Zimbabwe

Area Description	**Total Area (million) Ha**
Animal and manual draft (small scale farming)	1.0 ha
Motorized draft power (medium scale)	0.5 ha
Large scale farming (A2)	2.8 ha
Total arable land	4.31 ha

Source: Government of Zimbabwe, Transitional Stabilisation Programme (TSP), 2018

3.3.8 Zimbabwe's food crop production

Maize is the most popular crop because it is a staple food for both the nation and all of Southern Africa. However, the recent El Nino drought and Cyclone Idai (originating in the Indian Ocean), both of which occurred between 2016 and 2018, have caused a substantial fall in food output. These natural disasters leave a path of ruin and devastation behind them. According to Table 3.7, the overall food crop output decreased by 801 394 tons between 2016 and 2018.

Table 3.7 Population Dynamics of Zimbabwe

Food Crop	2017/2018 (tons)	2016/2017 (tons)	Variance	% Change
Maize	1,700,702	2,155,526	(454,824)	-21%
Sorghum	77,514	182,012	(104,498)	-57%
Pearl Millet	48,844	82,662	(33,818)	-41%
Finger Millet	9,085	24,107	(15,022)	-62%
Ground Nut	127,202	139,503	(12,301)	-9%
Round Nut	321,662	513,070	(191,408)	-37%
Sweet Potato	21,320	15,356	5,964	39%
Sugar Beans	59,772	35,744	24,028	67%
African Peas	16,380	35,895	(19,515)	-54%
TOTAL	**2,382,481**	**3,183,875**	**(801,394)**	**-25%**

Source: Reserve Bank of Zimbabwe (2018)

The two farming seasons noted in Table 3.7 above show a significant decrease in food production. The nation's principal grain, maize, experienced a decline of (21.1%), plunging many people into extreme poverty nationwide, and especially in the rural areas. The actual trends in food supply from food crops for the seasons 2016–2017 and 2017–2018 are shown in the graph in Figure 3.6

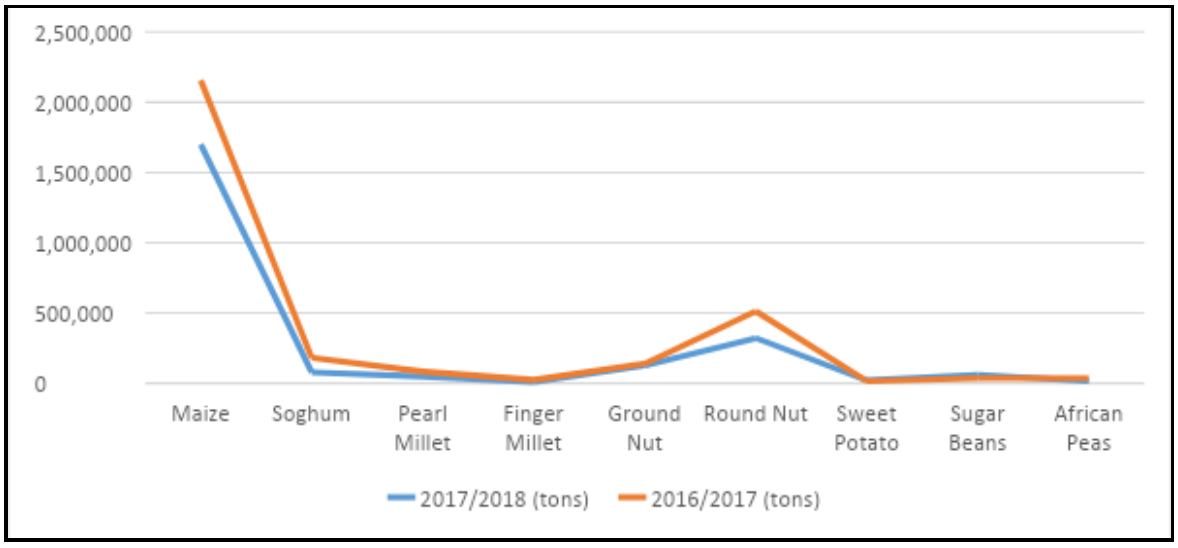

Figure 3.6 Crop Production in Zimbabwe

Source: Reserve Bank of Zimbabwe (2018)

Figure 3.6 depicts the changes in food crop output from 2016 to 2018. Between the farming seasons of 2016–2017 and 2017–2018, the national output of food crops fell, and the ongoing Elnino drought is mostly to blame.

3.3.9 GDP and Poverty in Zimbabwe

Zimbabwe's GDP in 2019 was US$13 billion while GDP per capital was US$749 per person (World Bank, 2020). The global COVID-19 epidemic, the El Nino drought, and other climate-related events, among others, contributed to the real GDP trending downward starting in 2019. (RBZ Monetary Policy Statement, 2020). The economy was anticipated to drop by (1.7%) before COVID-19, but the pandemic worsened the situation and caused the economy to contract by (8.7%), according to the World Bank (2020). The World Bank claims that structural flaws, climatic shocks, repeated years of drought, a lack of foreign cash, and power difficulties for the sector are to blame for the GDP contraction. Figure 3.7 below displays a graph of GDP changes from 2008 to 2020.

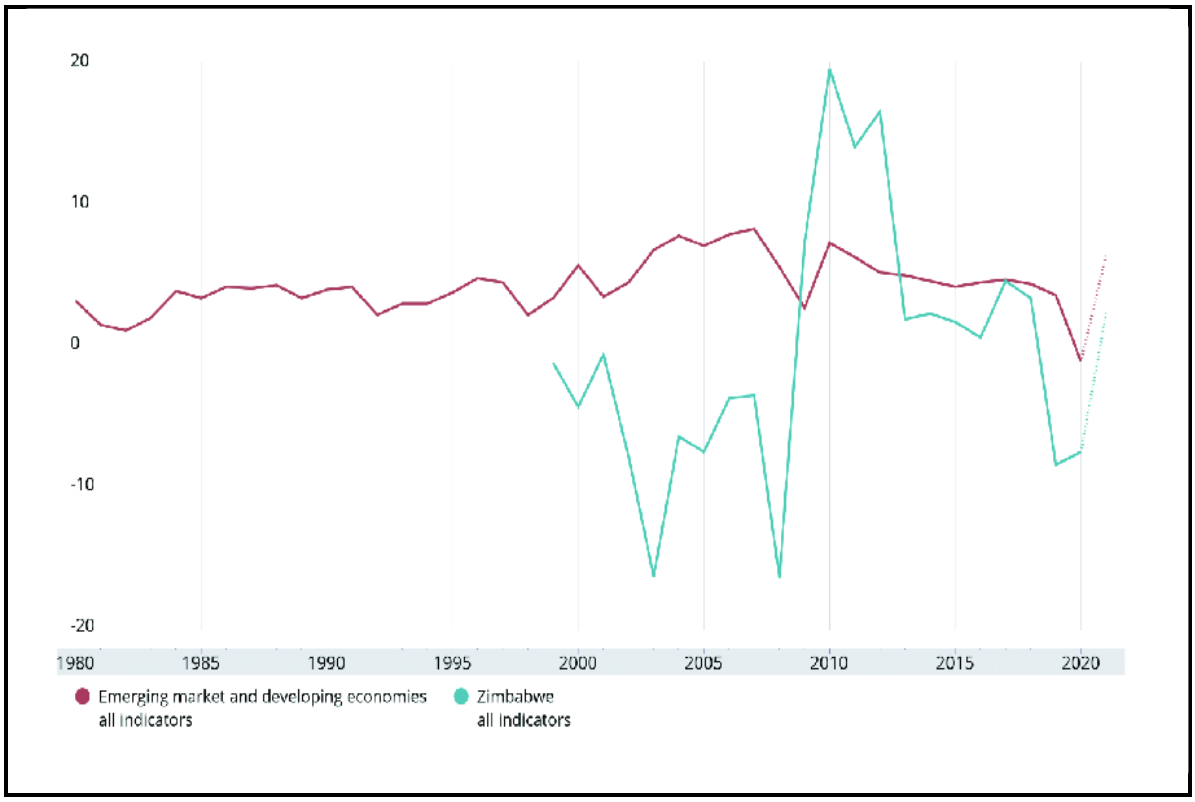

Figure 3.7 Zimbabwe GDP Trend 1980 - 2020

Source: World Bank (2020)

Zimbabwe saw a severe rise in poverty as a result of the country's ten-year economic collapse, and real per capita income plummeted drastically from roughly US$644 in 1990 to $433 in 2006 and an estimated $338 in 2008. Over (70%) of people are currently thought to be living

in poverty, up from (42%) in 1995 to (63%) in 2003. The Gini coefficient, which measures inequality, was considered to be one of the highest in the world in 2003, at (57%). According to some estimates, unemployment is at (80%). In Zimbabwe, an estimated 1.2 million people, or over (10%) of the population, have HIV/AIDS. Zimbabwe's gross national income (GNI) per capita dropped from tenth in Sub-Saharan Africa in 1980 to 34th out of the 48 Sub-Saharan nations in 2005. Therefore, in order to raise earnings to the levels that prevailed in the 1980s and the early 1990s, a sustained period of robust economic development will be necessary.

3.3.10 Health in Zimbabwe

Zimbabwe's GDP for health was measured at (9.4%) of GDP in 2018, which is higher than the typical Sub-Saharan African GDP proportion for health spending (IMF, 2019:11). Additionally, health spending exceeds the required SDG spending level (7.5%) of GDP. Zimbabwe has an identical HIV prevalence rate of (13.3%) in adults aged 15 to 49 as the US has (HIV.org, 2020). Moreover, 1.4 million people in Zimbabwe are HIV-positive overall. According to reports, each year, 40 000 people contract the AIDS virus, and 20 000 of them pass away. About (86%) of HIV-positive adults and (71%) of HIV-positive children are receiving antiretroviral therapy, respectively (avert.org, 2020). With 1.8 million documented cases in 2006 and 281 000 in 2016 (UNDP, 2018), malaria is still one of the leading causes of death in Zimbabwe. Additionally, (85%) of the population is at risk (MoHCC, 2020). People who are considered unhealthy have high incidence of being poor, as their human capital will not be functional (Grossman, 2010).

3.3.11 Education

According to the 2013 Zimbabwe Constitution, education is a fundamental human right. To buttress this erstwhile motion, the government created the Education Sector Strategic Plan 2016–2020, which supported the Sustainable Development Goals (SDGs) as a means to guarantee inclusive and equitable quality education support opportunities for all people. The SDGs targeted included SDG 4, which is on access to equitable and quality Early Childhood Development, care and pre-primary education for the readiness of children for primary education (Ministry of Primary and Secondary Education, 2018); SDG 5 which is on achieving gender equality and empowering all women and girls; and SDG 8 which sought to substantially reduce the proportion of youth not in employment, education, or training.

In Zimbabwe in 2018, there were 5 601 398 people aged 3 to 18 years old who were enrolled in school, with 2 804 775 girls and 2 796 623 boys (ZIMSTAT, 2019). Following the successful implementation of the Early Childhood Education (ECD) program in 2005, the country had 628 826 girls and 316 210 boys in ECD A and ECD B in 2018, while the overall number of

schoolchildren in elementary education was 2 725 970 (1 356 828 girls and 1 369 142). (Ministry of Primary and Secondary Education, 2019). According to the aforementioned figures, 2 875 428 children did not attend school in 2018 despite reports of improvements to school infrastructure brought on by the government's extension of education policy: 6 242 ECD public education facilities, 6 288 primary schools and 2 871 secondary schools (Ministry of Primary and Secondary Education, 2019).

The Ministry of Primary and Secondary Education (MOPSE) (2019) reports that there were 96 760 students in Forms 5 and 6 and 1 093 550 students in Forms 1-6, of which 996 790 were in Forms 1-4. Girls made up (47.41%) of this total's secondary enrolment, while boys made up (52.59%). Figure 4-7 shows a nine-year examination of Zimbabwe's education indicators for the years 2000 to 2014.

Less than the minimum of (4%) to (6%) of national GDP and/or between (15%) to (20%) of public spending must go into education to meet the UN SDGs and the Incheon Declaration (UN, 2020). Total enrolment in primary schools in Zimbabwe is higher and, in the majority of situations, above (100%). However, there are only about (50%) of secondary female students enrolled, which suggests that (50%) of female students left school before completing their secondary education and these school dropouts are potentially to be destined for inclusion in the poverty domain. UNDP MPI partakes education as an indicator which has a direct input to poverty (Stoeffler *et al.*, 2016).

3.3.12 Employment in Zimbabwe

With approximately (50%) of the population not working in the formal economy before 2004, Zimbabwe's unemployment rate has remained high. However, it peaked in 2020 with a formal employment rate of (59.4%). In contrast to the preferred unemployment rate (2%) to (3%), the current rate is (40.6%). As a result, Zimbabwe's unemployment rate is very high and indicates an unstable economy. The (37%) unemployment rate was the number that the UN and International Labor Organization (ILO) expected. especially for the year 2020 for Africa (ILO, 2021). Hence Zimbabwe’s unemployment rate of (4.6%) falls above Africa’s minimum.

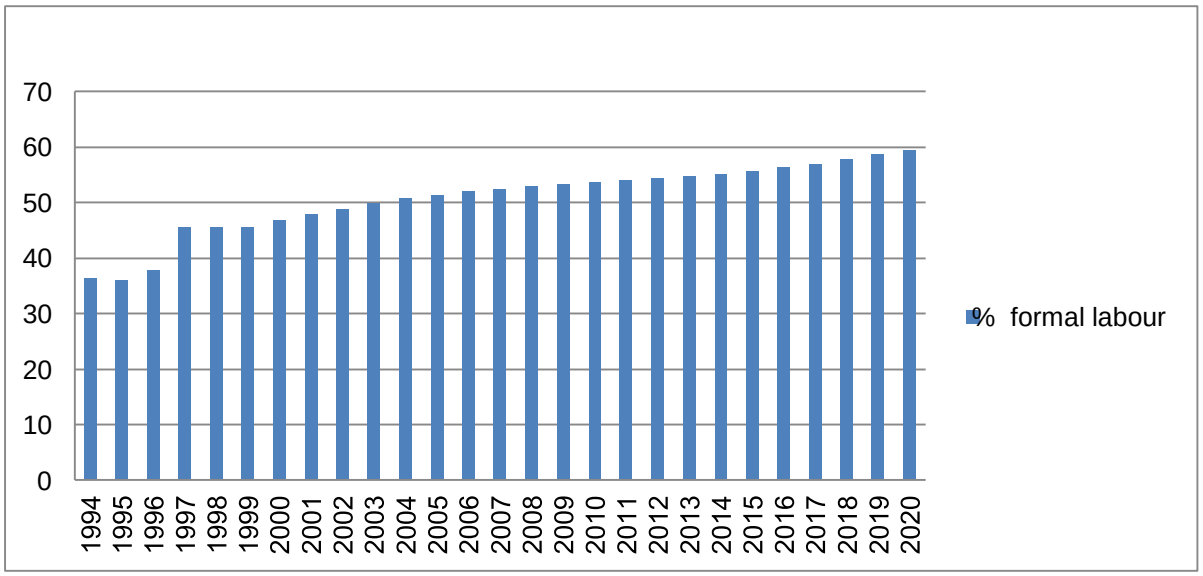

Figure 3.8 Formal Employment Rates in Zimbabwe

Source: ILO (2021)

3.3.13 Digitalisation in Zimbabwe

Given the country's solid knowledge base and abundant natural resources, Zimbabwe has the potential to figure amongst the countries leading growth in sub-Saharan Africa by 2020. Zimbabwe was ranked 113th in the Global Innovation Index in 2021. It is useful to think of the digital economy as having three primary components--supporting infrastructure, electronic business processes (how business is conducted), and electronic commerce transactions (selling of goods and services online).

3.3.14 Poverty trends in Zimbabwe

After independence in 1980, the poverty headcount ratio decreased to about (26%), but as a result of persistent droughts and the failure of the Economic Structural Adjustment Programme (ESAP), which was introduced in 1991, it progressively climbed to (35%) in the 1990s (World Bank, 2015:1). According to the ZIMSTAT (2015), the fast-track land reform initiative, which targeted over 4 600 white commercial farmers, caused poverty in Zimbabwe to rise to (63%) of households by 2003. In Zimbabwean slang, this *jambanja* caused a reduction in national agricultural yields of (85.7%), a collapse of the local currency that culminated in a (231,000,000%) hyperinflation, and the preference for economic sanctions against Zimbabwe.

International investors and international lending organizations like the IMF and World Bank isolated Zimbabwe economically. ZIMSTAT estimates poverty at (70.5%), although current estimates have it at (88%) (ZIMSTAT, 2017). As a matter of concern, (29.3%) of people live

in extreme poverty. Zimbabwe's poverty Gini index was projected to be (43.2%), while the country's international poverty rate was judged to be (21.5%) (World Bank, 2020).

In 2017, ZIMSTAT carried out Poverty Income Consumption and Expenditure Surveys, which revealed that (70.5%) of households in Zimbabwe are poor. Zimbabwe's food poverty line (FPL) was projected to be 31.2 USD on average, 31.7 USD in urban areas, and 30.5 USD in rural areas (ZIMSTAT, 2017:36-38).

According to the Zimbabwe Vulnerability Assessment Committee, rural residents in Zimbabwe are in such desperate need of emergency food assistance that (59%) of them would need it from 2019 to 2021. (ZimVAC, 2019). According to comparable reports, (60.6%) of households had per capita consumption that was below the poverty line (ZimVAC, 2019). Separately, the UN World Food Programme (WFP) anticipates that Zimbabwe will need emergency aid of USD $4,204 million in 2021 to feed its 4 million undernourished citizens in both rural and urban areas. Additionally, it projects that 6.9 million Zimbabweans, both in rural and urban regions, will need help due to an unavoidable danger of food poverty (UNWFP, 2021; Southern Africa Social Protection Experts network, 2021). In 2017, the TCPL for Zimbabwe was expected to be (70.36%) (ZIMSTAT, 2017:38). TCPL for 2017 is shown in Table 3.8.

Table 3.8 Poverty Lines in Zimbabwe

Poverty Line	Average	TCPL (A+B)
Food Poverty Line (A)	USD$31.27	
Non-Food Poverty Line (B)	USD$39.09	70.36

Source: ZIMSTAT (2017)

Zimbabwe's Gini coefficient, which gauges the distribution of happiness, was 0.45. Due to an increase in personal poverty from (30.4%) to (40.9%), extreme poverty climbed from (22.5%) to (29.3%) between 2012 and 2017 (ZIMSTAT, 2017:19). According to ZIMSTAT, urban poverty is increasing more quickly than rural poverty (2017). The Gini coefficient demonstrates that happiness is not spread equally in Zimbabwe. In Table 4-22 below, major measures of poverty in Zimbabwe are analysed:

Table 3.9 Poverty Indicators by ZIMSTAT

Poverty Indicator	2018	2019	2020	2021
Life expectancy at birth, total (years)	61.19	61.49	61.738	61.965
Dependency ratio, Total	82.9	82.2	81.52	79.785
Birth rate, crude (per 1,000 people)	30.67	29.74	28.97	28.36

Death rate, crude (per 1,000 people)	7.883	7.773	7.692	7.626
Mortality rate, under-5 (per 1,000)	46.22	45.62	47.23	43.29
Fertility rate, total (births per woman)	3.615	3.531	3.46	3.398

Source: ZIMSTAT (2022)

According to UNDP (2020), in 2018, the life-expectancy at birth for males was (59.5%) and for females it was 62.2. Additionally, it said that the infant death rate was 36.5 per 1000. In 2018, child malnutrition was estimated to be at (27.1%), while tuberculosis was reported to be 220 per 100 000 (UNDP, 2020). Table 3.9 highlights this information.

Table 3.2 Health Indicators

Health Variable Indicator	Value
Life expectancy female	62.2%
Life expectancy male	59.5%
HIV prevalence (15-49 years)	13.3%
Malaria risk (national)	95.2%
Tuberculosis per 100 000	221
Adult mortality female per 1000	300
Adult mortality male per 1000	362
Mortality rate for children below 5 years per 1000	50.3

Source: ZIMSTAT (2020)

Since the causes of poverty in rural and urban areas are different, changes in poverty between the two need to be analysed. Using PICES and ICES, Table 3.11 below compares poverty in Zimbabwe's rural and urban areas.

Table 3.3 Poverty using PICES and ICES

PICES & ICES	Poverty	Extreme poverty	Poverty gap index	Poverty severity index
PICES 2017				
Rural	86.0	40.9	43.5	25.4
Urban	37.0	4.4	11.3	4.8
All Zimbabwe	70.5	29.3	33.3	18.9
PICES & ICES	**Poverty**	**Extreme poverty**	**Poverty gap index**	**Poverty severity index**

PICES 2012				
Rural	84.3	30.4	42.8	25.4
Urban	46.5	5.6	15.5	7.2
All Zimbabwe	72.3	22.5	34.1	19.6
ICES 2001				
Rural	82.4	52.4	43.4	27.0
Urban	42.3	14.5	15.5	7.6
All Zimbabwe	70.9	41.5	35.4	21.4
ICES 1995				
Rural	86.4	62.8	47.1	29.6
Urban	53.4	15.0	20.2	10.0
All Zimbabwe	75.6	47.2	38.3	23.2

Source: ZIMSTAT (2020)

Table 3.11 above clearly shows that Poverty Income Consumption and Expenditure (PICES) and the Index on Consumption and Expenditure Survey (ICES) from 1995 to 2017 in rural areas and in urban areas are different.

3.3.12.1 Poverty severity and distribution in Zimbabwe

Table 3.4 Poverty Severity Distribution in Provinces

Province	**Percent Poor people**		**Very poor people**	**Poverty gap index**
Manicaland	16.4		36.9	40.0
Mashonaland Central	12.0		49.5	47.9
Mashonaland East	12.2		29.9	35.5
Mashonaland West	12.6		38.7	39.9
Matabeleland North	6.5		45.1	44.6
Matabeleland South	5.7		27.3	34.3
Midlands	11.8		30.2	34.9
Masvingo	13.3		27.9	34.0

Bulawayo	2.2		1.3	7.1
Harare Province	7.3		5.2	12.2
All Zimbabwe	100.0		29.3	33.3

Source: ZIMSTAT (2020)

According to Table 3.12 above, (70.5%) of Zimbabweans are classified as poor, with (29.3%) of them being extremely poor. Mashonaland Central is the province with the highest percentage of impoverished people (87.9%), as well as the highest percentage of very poor individuals.

3.4 ECONOMICALLY ACTIVE PEOPLE IN ZIMBABWE

According to ZIMSTAT (2020), and in line with the context of the 2022 population census, the phrase "labour force" refers to those who are economically active. The term is consistent with what the National Accounts and Balances require. A population's activity and labour force analysis paint a picture of the population's manpower and a breakdown of the labour force's activities. Information was gathered from people who are 10 years of age and older. People between the ages of 10 and 14 years old were interviewed about their activities primarily to learn more about children who work and the results shows that already active in sustainable employment such as house chores.

The whole population that is available for the production of goods and services as shown by national income figures is referred to as the economically active population. These people include paid workers and employers, unpaid family members, self-employed people, and jobless people. On the other hand, the activities of the economically inactive population include "homemaking", studying, and being ill or too old. It is significant to highlight that even while most women mix housework with other economically productive occupations, they frequently claim being homemakers.

The term "economically active population" refers to the amount of people accessible for the production of products and services, according to ZIMSTAT (2020). This group consists of paid employees, employers, unpaid family workers, self-employed people, and employees. The study found that even while most women mix housework with other economically beneficial occupations, most of them tend to identify as housewives. In the categories of own account worker and unpaid family worker, there were more women than men. In contrast, there were more men than women in the paid employee, employer, and unemployed

categories. There were about equally as many men and women among those who were economically active.

The activity rate was defined as the proportion of economically active people in a population out of every 100 people in that population by the 2002 Census. Calculating the rate involves dividing the number of people who are economically active and over the age of 15 by the total number of people in that age group, then multiplying the result by 100 (ZIMSTAT, 2020).

3.5 EMPIRICAL STUDIES OF DIGITALISATION AND POVERTY

This section reviews various literature which thematically relates to the relationships between digitalization and poverty. Most empirical literatures have been studied majoring on information and communication technologies (ICTs) and poverty, however, this study focuses on digitalization which encompasses ICTs. Most studies hinged their discussion on poverty yet in this study a more comprehensive approach which is multidimensional poverty is harnessed. This makes this study to be unique. Studies reviewed in this section include Savulescu (2015), Toader *et al.* (2018) and Oshota (2019), Yılmaz *et al.* (2018), Ma *et al.* (2018), Masango (2018), David (2019), Martinez (2020), Alimi and Okunade, (2020), Akinboade *et al.* (2021), Yang *et al.* (2021), Mateko (2022), Olamide *et al.* (2022) on their order of chronology.

Savulescu (2015) researched the evolution of ICT in the European Union. The study's goal was to look at the relationship between the size of the ICT sector and network readiness in European Union economies. In the study, comparative analysis was used. According to research findings, ICT is a good tool for boosting economic growth (Savulescu, 2015:7). There is no clear description of possible areas of the EU economies where ICT may be funnelled to achieve high economic growth, and there is no explanation of how ICT can be utilised as a tool to link with economic growth.

Toader *et al.* (2018) and Oshota (2019) have opposing research perspectives on the impact of ICT on economic growth. This can be attributable to variances in ICT usage and penetration levels among countries. Toader *et al.* (2018) conducted study on European economies. Such countries will often have higher ICT penetration rates than Nigeria, explaining the disparities between the two research findings. This study demonstrated that ICT may be utilised to alleviate poverty and that ICT has a role to play in all sectors of an economy. Entrepreneurs in the manufacturing, service and banking sectors can all benefit from ICT.

Toader et al. (2018) investigated the impact of ICT infrastructure on European economic growth. The research technique was quantitative, and it was discovered that ICT infrastructure

has a favourable and significant impact on economic growth (Toader et al. 2018: 16). As a result, a rise in ICT infrastructure contributes to stronger economic growth, which improves living standards. Since ICT enables mass production of items in the manufacturing sector, the price of some goods may be reduced due to the laws of demand and supply. However, the study lacks a concise explanation of how ICT might be employed as a driver of economic growth and aid in poverty reduction. This demonstrates the importance of filling those gaps.

A study by Yimaz *et al.* (2018) investigated the contribution of information and communication technology to poverty reduction using secondary data from 182 countries for the period 2000 to 2013, using a panel data analysis methodology. The relationship between information and communication technologies (ICTs) and poverty was empirically examined by Yilmaz *et al*. (2018). Yilmaz *et al* (2018) used six poverty indicators which were human development indicator (HDI), the GINI index, headcount ratio, the mean lag deviation (MLD), poverty gap, and Watts poverty index; whereas the information and communication technology variable was represented by internet, mobile, landline and computers. The results from Yilzman *et al.* (2018) showed that there are statistically significant relationships between poverty indicators and ICT indicators. Internet use is discovered to have the greatest impact on all measures of poverty amongst the ICTs. The highest effect of internet penetration amongst ICT variables suggests that, in addition to its other effects noted in the literature, encouraging internet dissemination and enhancing internet access are crucial for combating poverty and reducing income inequality. The study by Yilzman *et al* (2018) relates to the current study in terms of searching the relationship between ICTs and poverty, because of the 182 countries included in the analysis by Yilzman *et al* (2018), Zimbabwe was one the observations. Moreover, Yilzman *et al.* (2018) used internet, computers and cell phone as representing the ICT variable, which is similar to what this current study is using. However, the difference is that Yilzman *et al.* (2018) used secondary data yet in this study, it's primary research, and moreover this research focuses on a province of Zimbabwe which is Mashonaland East.

Ma *et al.* (2018) investigated the relationship between smartphone use and income growth in rural China. The study by Ma *et al*. (2018) used mobile internet as a variable for ICT and the poverty aspect was assumed by rural economic development which was operationalized as rural household income. The findings from Ma *et al.* (2018), which were based on primary household-level survey data from rural China and an endogenous switching regression model, showed that the primary factors influencing smartphone use are gender, farmers' education levels, farm size, and participation in off-farm jobs. That research also found that smartphone use significantly raises family income, off-farm income and farm income, and that there is a statistically significant difference in the income effects between male and female smartphone

users. This research hinted on the use of mobile internet, which is beyond use of mobile phones or internet, which are separated in this current study. However, the geo-spatial setting of China, a developed country contracts the current study setting which is a Sub-Saharan developing country province. Moreover, the aspect of digitalization is not espoused more, despite endearing the issue of having gender, participation in jobs and education being part of the analysis, the same aspects which are inculcated in multidimensional poverty analysis.

Masango (2018) researched ICT innovation and economic development in South Africa's Soweto Townships. Masango (2018) used a township economy application to represent the ICT aspect, while poverty was represented by small to medium enterprises uptake of the application. The interesting aspect is that Masango (2018)'s research is a primary data survey, and the focus was to check if the local townships in Soweto could use this ICT application for productivity. The results showed less uptake of the township economy application in Soweto South Africa. Masango (2018)'s study relates to how ICT may be related to economic development, though the study was a qualitative one.

Adding more, David (2019) did a study which looked into how telecommunications activities affect the economic growth and development of several African nations using 46 African nations are included in the investigation, which spans the years 2000 to 2015. Real gross domestic product (GDP) is used as a proxy to evaluate economic growth, while the Human Development Index measures economic development and a composite index of telecommunication operations is used to gauge Internet access penetration and mobile, fixed, and CDMA line penetration. Gross fixed capital formation, employment to population ratio, enrollment in secondary school for both sexes, and net inflows of foreign direct investment into Africa are used to gauge the physical capital stock, human capital development and technology transfer. David (2019) found that telecommunications activities support economic expansion and development in Africa, and the suggestion is that aggregate output and standard of living will increase in Africa for every increase in telecommunication operations and physical capital assets, and thus ICT is related to poverty reduction.

Martinez (2020) studied how an ICT aspect operationalized as mobile phone adoption and poverty operationalized as family income in rural Mexico are related. Despite the study being secondary data from the National Household Income and Expenditure survey, an interesting relation is the utilization of the panel data and probit model as used in this study. The findings of Martinez (2020) showed that non-agricultural activities increase the probability of mobile phone usage, and work in activities off-farm, as well as the adoption of cell phones increase household income. Martinez's (2020) findings suggest that digital inclusion and employment policies do improve the standard of living of the rural populations, which is part of the agenda

in the current research. The outstanding issue mentioned by Martinez (2020) is digital inclusion, which is a multidimensional criterion, as opposed to stand-alone phenomenon.

Alimi and Okunade (2020) worked on research focusing on financial inclusion, ICT diffusion and poverty reduction in Sub-Sahara African countries. The ICT variable was represented by internet and mobile subscriptions while poverty variable was represented by economic growth. Inflation was included as a control variable, and the data was manipulated using secondary sources from 27 countries, and an ADL model, pooled mean group and dynamic fixed effects modelling was used. The findings from) showed that ICT represented by mobile penetration has no effect on poverty in both the short run and in the long run, which is quiet contributory to the debate in this study, where the probe on whether there is a relation or not exists between digitalization and multidimensional poverty. The weakness in Alimi and Okunade's (2020) study is that ICT was proxied by internet and mobile subscription, and hence if the range of variables representing ICT increase, the results may differ.

Akinboade *et al.* (2021) discuss access to information and communication technology (ICT) in the context of food security in Soshanguve, a slum area of The City of Tshwane, which is the administrative capital of South Africa. The ICT was represented by a rich bundle comprising cellular phone, television, satellite television, radio, computer and telephone landline while the food security was an aspect representing poverty. Akinboade *et al.* (2021) underscored that ICT is a potential weapon in the battle against hunger and food insecurity because of how quickly it is being used and applied. In Soshanguve, a sample of 300 randomly chosen households were given surveys using the questions from the USAID-developed Household Food Insecurity Access Scale (HFIAS) and utilized a correlation analysis. The findings showed that ICT access is positively associated with household food security, which illuminated the assumption that digitalization has a negative association with poverty.

Yang *et al.* (2021) scrutinized mobile internet use and multidimensional poverty using a household survey in rural China. The ICT variable was represented by mobile internet while the poverty was proxied by multidimensional head count ratio in line with Alkire and Foster (2011). The research was a primary household survey which was conducted in three provinces of China. The findings of Yang *et al.* (2021) were that an ICT aspect of mobile internet exerts a negative and significant effect on multidimensional poverty. Yang *et al.* (2021) relates significantly with the current study in that, firstly, it majors on multidimensional poverty as a poverty variable; and secondly, it investigated the problem using primary research; and lastly, it focused on provinces in China. However, its ICT variable was a sole aspect mobile internet,

and to add on, China is an Asian developed country as compared to Zimbabwe which a developing nation.

In a recent study by Olamide *et al* (2022), in research which looked at the triangle interaction between economic growth, information and communication technology, and poverty in SADC, a Mean-Group FMOLS, Mean-Group DOLS, and Robustness Mean-Group Estimators were used to manipulate data spanning from 2005 to 2015 of 16 SADC countries. Olamide *et al.* (2011) found out that long-run associations exist among the variables of interest namely poverty, information, and communication technology. Olamide *et al.* (2022) further established that the long-run effects of ICT, economic growth, financial development, and trade openness are poverty-reducing and hence, ICT was seen as a tool for accelerating economic growth in SADC as a region.

Akinboade *et al.* (2021) discuss access to information and communication technology (ICT) in the context of food security in Soshanguve, a slum area of The City of Tshwane, the administrative Capital of South Africa, food security being an aspect of poverty. Akinboade *et al.* (2021) underscored that ICT is a potential weapon in the battle against hunger and food insecurity because of how quickly it is being used and applied. In Soshanguve, a sample of 300 randomly chosen households were given surveys using the questions from the USAID-developed Household Food Insecurity Access Scale (HFIAS), and utilized a correlation analysis, and found out that ICT access is positively associated with household food security.

Mateko (2022) researched on the nexus between diffusion and poverty level in Sub Saharan African countries. Mateko *et al.* (2022) used fixed telephone, mobile telephone and internet usage as the ICT aspect, and the poverty aspect as real GDP per capital, though other control variables such as foreign direct investment, development aid, primary school enrolment, remittances and private domestic credit. This was secondary research utilizing data from Sub-Saharan Africa from 1989 to 2019, using a generalize methods of moments. The findings from Mateko (2022) were that an increase in the usage of ICT does reduce poverty. The relevance of Mateko's (2022) research is that it firstly probes on the relation between ICT and poverty reduction. Secondly, its ICT variable has fixed telephone, mobile telephone and internet usage which aligns to current study. However, the poverty related variable was real GDP per capital, yet in this study the focus is on multidimensional poverty index. The other notable difference is that Mateko (2022) used secondary data which requires a lot of cleaning, diagnosis and use of control variables for usability, yet this research will use primary data from Mashonaland East of Zimbabwe.

In a recent study by Olamide *et al.* (2022), in research which looked at the triangle interaction between economic growth, information and communication technology, and poverty in SADC, a Mean-Group FMOLS, Mean-Group DOLS, and Robustness Mean-Group Estimators were used to manipulate data spanning from 2005 to 2015 of 16 SADC countries. Olamide *et al.* (2011) found that a long-run association exists amongst the variables of interest, namely poverty, information and communication technology. Olamide *et al.* (2022) further established that the long-run effects of ICT, economic growth, financial development, and trade openness are poverty-reducing and hence, ICT was seen as a tool for accelerating economic growth in SADC as a region.

3.6 GAPS IN LITERATURE

The majority of studies reviewed are showing that the ICT variable is represented by mobile phone and internet or internet usage [Yılmaz *et al.* (2018), Ma *et al.* (2018), David (2019), Martinez (2020), Alimi & Okunade (2020), Akinboade *et al.* (2021), Yang *et al.* (2021), Mateko (2022), Olamide *et al.* (2022)], except for Masango (2018) who focused on a mobile application's uptake. There is more need to expose on how poor people are able to utilize mobile applications for productivity, instead of simply investigating possession of an ICT gadget without exploring the capability and functionality aspect. This research focuses on ICT and includes uptake of mobile applications, emails, and having a digital satellite television. These variables utilise the same internet, mobile and computer, but are of extended digitalization capacity, in line with the capabilities approach by Sen (1976).

The studies reviewed measured poverty in variegated ways such as family income (Martinez, 2020), real GDP per capita (Mateko, 2022), human development index (Yilzman *et al.* 2018; David, 2019) and many others. Very few studies have used multidimensional poverty index, and amongst the few is Alimi and Okunade's (2020) study, which indicates that there is still a gap to explore poverty using the contemporary inclusive measure of poverty, which was rubber stamped by the UNDP (2015).

The vast studies which attempt to address relationship and or causality between digitalization in the form of ICTs and poverty have been comfortable in the use of secondary data [(Yılmaz *et al*. 2018; David 2019; Martinez, 2020; Alimi & Okunade, 2020; Akinboade *et al.* (2021; Mateko, 2022), Olamide *et al.* 2022)]. Very few studies have utilized primary research to fetch the relationship between digitalization and or ICTs and poverty in the form of multidimensional insufficiency. This study is going to explore the relationship between digitalization and multidimensional poverty, in Mashonaland East of Zimbabwe. A few studies which have used primary research to explore the relationship in this context, carried the study in China (Yang

et al., 2018) and in South Africa (Masango, 2018 and Akinboade *et al.*, 2021), and none in Zimbabwe at provincial levels.

The methodologies used by various researchers seeking to explain the relationship between ICT and poverty used vector auto-regression (David, 2019), general methods of moments (Mateko, 2022), logistic models (Yilzman *et al.,* 2018), mean group estimators (Olamide *et al.*, 2022). However, this research is to use the probit logistic models from cross-sectional data obtained using primary data collection techniques.

3.7 CHAPTER CONCLUSION

The digitalisation and poverty contexts were checked using a funnel bottom approach, from an inter-continental level, continental level, country level and lastly to a provincial level. The researcher discovered that there is very little research at provincial levels in Zimbabwe pertaining to aspects of multidimensional poverty and digitalisation. However, considerable empirical literature from Africa and beyond has been analysed in relation to the current study. Of interest are some empirical studies being done in South Africa, which relate closely to the Zimbabwean situation due to geopolitical proximity. On a national scale, the Government of Zimbabwe does have an ICT Policy whose other facets have been to provide computers to all schools in Zimbabwe, especially the rural schools, but capability and enabling environment is greatly lacking, as stated by Kungeni (2017). Zimbabwe's ICT policies are suffering because the people are already poor as they lack agricultural education, capacity to farm despite having the land (Makunike, 2014), and efforts to get a digital gadget which connects to internet will become a nightmare if the stomach is hungry for starters. POTRAZ (2022), however, purports that Zimbabwe has over 13 million mobile subscribers (Econet, Telecel and Netone) out of a population of 15 million, which translates to about 86% mobile uptake, yet Manjengwa *et al* (2012) propound that four out of five people, which translates to 90%, in Zimbabwe are poor. This provides an inquiry and quest to explore the core objective of the study, which is to find out the relationship between digitalisation and multidimensional poverty in one of the provinces of Zimbabwe. The conceptualisation of poverty, poverty dimensions, digital poverty will provide a platform for literature review to be provided, which will address theoretical objectives of the study, and this is what is forthcoming in the next chapter.

This chapter dwelt on empirical literature reviews from a world perspective down to a provincial aspect. Gaps in the empirical literature have been found and are a reason to proceed with the research. The outcome of the research will go a long way towards addressing some policy concerns in Zimbabwe, SADC, other countries and institutions which are interested in harnessing poverty and all its types in the face of digitalisation.

CHAPTER 4: DATA AND METHODOLOGY

4.1 INTRODUCTION

This chapter explains the methodology utilised to accomplish the objectives of this study as stated in the introductory chapter, guided by the theoretical framework and relevant empirical assertions. The technique and research strategy used in the study are presented, followed by the research design and model specification whose main focus is to address the research questions. This chapter explains econometric methods of analysis, model design, and measurement of indicators of all the research goals. According to the research needs, correlation analysis is meant to answer the first objective of the study. The third research objective seeks to address the causality relationship which may exist between digitalisation and poverty, and the Demitrescu-Hurlin test for causality will be employed. The ordinary least squares, fixed effects models, random effects models are all explained, and GMM estimators are explored empirically to achieve the fourth objective of this research work. Pre-estimation test as well as some post-estimation-tests will be employed, which include the multicollinearity tests, stationarity test and heteroscedasticity tests. On the post-estimation side, the tests to be used include but are not limited to Sargan tests, Wald tests and Arellano Bond serial correlation tests. To buttress the understanding of the model to be presented is the definition of all variables, as well as assumed signs before manipulation, providing a purview of a priori expectations. The focus of the research is on the relationship between the exogenous variable digitalisation, which is a composite index of internet, computer and cell-phone and the endogenous variable, which is poverty, represented by the international wealth index in the ten provinces of Zimbabwe for a period from 2006 to 2020. However, control variables, which are education, health, household size, electricity, quality of house, asset ownership and urbanisation, are included so that the analysis ring-fences the problem at hand, so that well informed and appropriate policies to alleviate poverty can be crafted.

4.2 RESEARCH PHILOSOPHY

According to Andriukaitiene, Vveinhardt and Zukauskas (2013), the research philosophy is a viewpoint on how information or data about a phenomenon should be gathered, analysed and used. Pozzebon (2018) states that a scientific enquiry can be grounded in interpretivism, realism, positivism, or pragmatism. On positivism, the existing body of study is based on large

samples of data which can be qualitative or quantitative. The appropriate data-gathering technique(s) for each philosophy is shown in Figure 4.1.

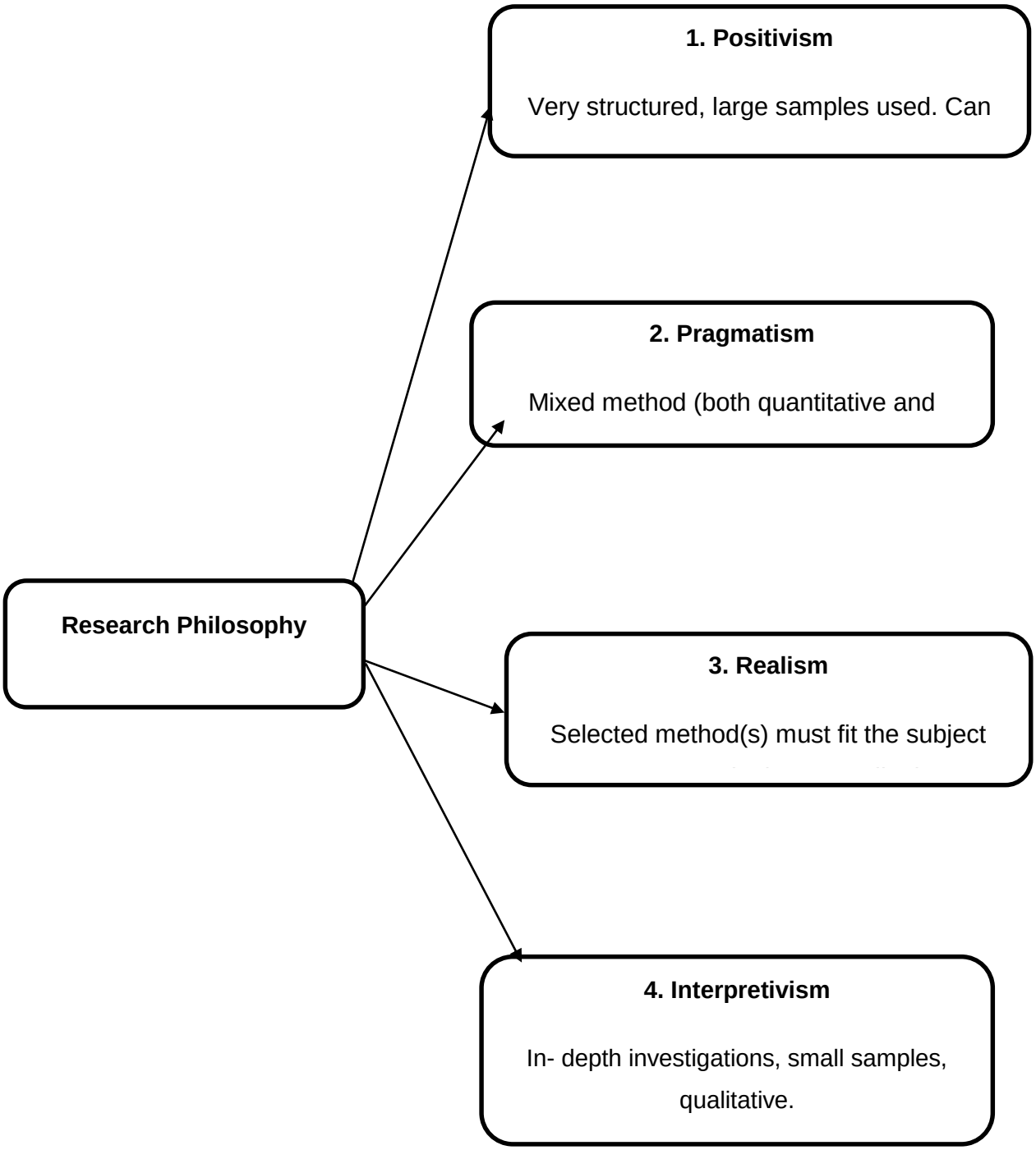

Figure 4.1: Research Philosophies

Source: Mateko (2021)

Figure 4.1 demonstrates that the positivist philosophy is highly structured, uses sizable samples, and can use either a quantitative or qualitative approach. However, pragmatism relies on a mixed-methods approach (Hashemi & Daneshfar, 2020). The idea that the chosen method(s) must match the subject matter is the foundation of the realism philosophy (Pham, 2018). The study will utilize measurable indicators; hence a quantitative technique will be used. Employing tiny samples, the researcher can conduct in-depth investigations using interpretivism (Ryan, 2018). In this study, the philosophy to be utilized is the positivism approach because the sample is large (n > 30) and can be used for both qualitative and quantitative research designs. Moreover, positivism is compatible with measurable quantities, which gives proper cause-and-effect relationships in search of answering the scientific inquiries presented in Chapter 1. This method (positivism) was chosen for the study because it enabled the researcher to employ a large sample size of households in the ten provinces of Zimbabwe. The selection of positivism made it possible to get useful study findings for application in the real world (Pham, 2018). The results of the research will be helpful for all developing economies in this situation.

4.3 RESEARCH DESIGN

According to Kubisch (2020), a framework and structure for an inquiry created to find answers to the research questions is known as a research design. Devisch (2019) stipulated that a research design is a description of how to carry out scientific research to guarantee the reliability and validity of outcomes. There are three main categories of research design: mixed techniques, qualitative, and quantitative (Leppink, 2017). Quantitative design is based on positivism, but qualitative design is based on interpretative philosophy (reality does not exist) (Mitchell, 2020).

In qualitative research, the researcher formulates wide, all-encompassing questions; gathers information mostly from respondents' comments; characterizes and examines these words to identify themes; and conducts the investigation in a neutral and subjective way (Wagner, 2020). According to Hou (2020), the qualitative research method entails examining people's daily lives in their natural environments.

The quantitative approach asks focused questions, gathers measurable numerical information from respondents, uses statistics to analyze it, and carries out the investigation impartially (Meng, 2020). The two designs are combined in the mixed-methods approach. In this study, the quantitative research approach was employed to analyze the data on the relationship

between poverty and digitalisation in Zimbabwe. Suarez (2017) and Younis *et al.* (2019) pointed out that utilizing a quantitative methodology is important since it will make it possible to objectively validate the research findings in terms of credibility, validity and dependability. Before expanding on the quantitative research design, as in any research, a descriptive research design will be inculcated.

4.4 CONCEPTUAL FRAMEWORK

In line with Global Data Labs (GDL) 4.2.1, the major socio-economic variables are categorized as follows: poverty, education, education attendance, position of women, position of children, asset ownership, access to public services, population and house quality. Using the GDL data, version 4.2.1 in collaboration with version 7.0, the researcher is going to extract variables of interest as follows:

Table 4.1 List of variables

VARIABLE	SYMBOL	SOURCE
1. POVERTY	IWI (International Wealth Index)	Global Data Lab SHDI-SGDI-Total 4.2.1
2. DIGITALISATION	DIG : A composite index of TV, Cell phone, Computer and Internet	Global Data Lab SHDI-SGDI-Total 4.2.1 And World Bank
3. EDUCATION	EDU: Access to education	Global Data Lab SHDI-SGDI-Total 7.0
4. HEALTH	HEA: Access to health	Global Data Lab SHDI-SGDI-Total 7.0
5. ASSET OWNERSHIP	ASSET: A composite index of owning refrigerator and motorbike	Global Data Lab SHDI-SGDI-Total 4.2.1
6.ACCESS TO PUBLIC SERVICES	ELE: Access to electricity	Global Data Lab SHDI-SGDI-Total 4.2.1
7. HOUSEHOLD SIZE (SIZE)	HHSE: Household size from the Population section	Global Data Lab SHDI-SGDI-Total 4.2.1
8. QUALITY OF HOUSING	HSEQ: Percentage of cases of houses none or small sleeping room	Global Data Lab SHDI-SGDI-Total 4.2.1
9. URBANIZATION	URB: Percentage of people living in urban areas	Global Data Lab SHDI-SGDI-

		Total 4.2.1

Source: Researcher's illustrations (2023)

The conceptual framework is informed by the theoretical works of Sen's (1995) capabilities approach. According to Sen (1995), the capacities range from more basic social factors like self-assurance in one's appearance and community involvement to more complex physical life features like having enough food, shelter, clothing, and morbidity-free time which are factors affecting poverty. The theoretical foundations of Sen (1995) are amplified in the Stigliz-Sen-Fitoussi (2009), argued that the measure of well-being was composed of health, education, personal activities, political voice and governance, social connections and relationships, environment, insecurity and material living standards, which aligns to the functionings which a person yearns to achieve. Sen (1995), alongside the Stigliz-Sen-Fitoussi (2009) model, played a pivotal role in the crafting of the global multidimensional poverty index (MPI), which is an international measure that directly measures the combination of deprivations that each household experiences (Alkire, 2011). The MPI stipulates that multidimensional poverty is determined by the three dimensions of health, education and living standards, and the three dimensions do have a total of ten indicators.

The current study used Sen (1995), alongside the Stigliz-Sen-Fitoussi (2009) determinants of well-being as well as Alkire's (2011) MPI, which is widely adopted by the UNDP, to craft the determinants of poverty as illustrated by Figure 4.2.

In this current study, poverty is proxied by the international wealth index, and that aligns to Alkire's (2011) and the Stigliz-Sen-Fitoussi's (2009) well-being**.** The various determinants of poverty listed in this current study are in line with the Sen (1995) functionings, the Stigliz-Sen-Fitoussi (2009) determinants, as well as Alkire's (2011) array of factors.

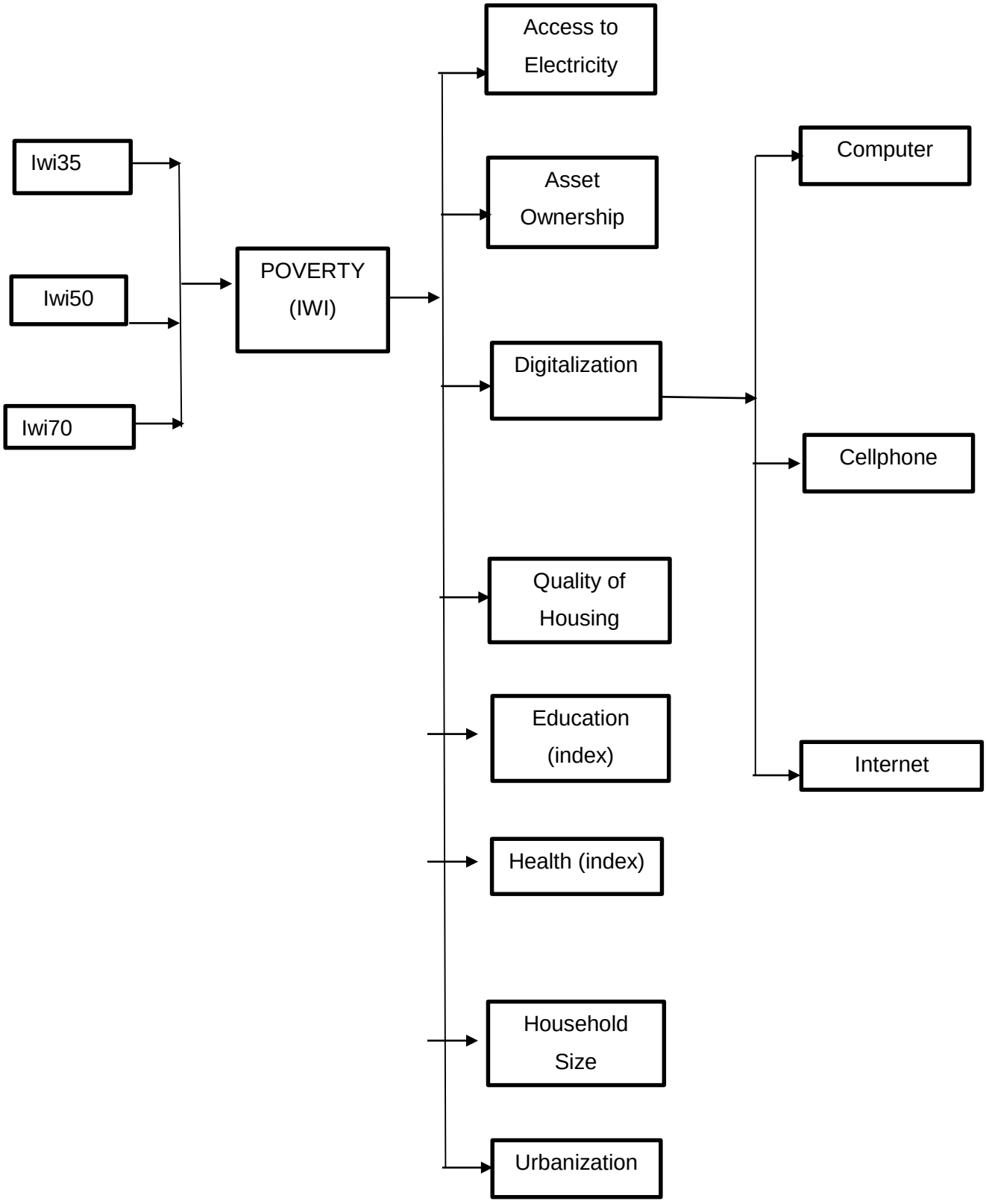

Figure 4.2: Conceptual Framework

Source: Researcher's own illustration (2023)

4.5 MODEL SPECIFICATION

4.5.1 The models

The main focus of the research is to investigate if there is a relationship between poverty and digitalisation through a correlation analysis, check causality through the Dimitrescu and Hurlin causality test and gauge the effect of digitalisation and poverty through panel ordinary least squares (OLS), fixed effect, random effect and generalised methods of moments (GMM) models, which are all helpful in attaining this study's empirical research goals (Tripathi & Seth, 2022; Bennet, Kallus & Schnabel, 2019).

4.5.1.1 Correlation and Causality

This study introduces a simplistic relationship analysis using the correlation analysis to investigate the linear relationship between poverty and digitalisation in Zimbabwe, and a panel ordinary least squares (OLS) model will be the vehicle which will assist explore this agenda. The OLS basic equation popularly known as the y = a + bx is the basis for checking linear relationships between the explained and explanatory variable (y and x respectively), as well as correlation, which shows direction and strength of the linear relationship. This research has an explained variable, poverty and many explanatory variables, in the form of digitalisation, education, health, household size, electricity, asset ownership, urbanization and house quality, which makes use of a correlation matrix viable to show the relationships. The OLS model to be used is as follows:

$$IWI_{it} = \beta_1 it + \beta_2\, DIG_{it} + \beta_3 EDU_{it} + \beta_4 HEA_{it} + \beta_5 HHSE_{it} + \beta_6 ELEC_{it} + B_7 ASSET_{it} + \beta_8 URB_{it} + \beta_9 HSEQ_{it-} + \varepsilon_{it} \quad \text{.....(4.1)}$$

Where IWI_{it} represents the endogenous variable, poverty. Exogenous variables in the model are digitalisation (DIG), education (EDU), health (HEA), household size (HHSE), electricity (ELE), asset ownership (ASSET), urbanization (URB) and house quality and electricity (HSEQ). These variables are vital when it comes to poverty and are supported by the fact that all of them have an impact on the well-being of people. The coefficients of the explanatory variables are represented by β_1, β_2, β_3 up to β_9 and $\mathcal{E}it$ denotes the stochastic error term. The OLS will be subjected to pre-estimation test which will include multicollinearity, heteroscedasticity and stationary tests, so as to maintain validity, reliability and consistence in causality and impact models.

To gauge which variable causes the other between poverty and digitalisation, the Dumitrescu and Hurlin (2012) test will be employed and that will aid in depicting the direction of causality between variables (Dumitrescu & Hurlin, 2012). The aprori expectations are that digitalisation and poverty have a bi-directional causality.

This research is going to further use the fixed effects model, random effects model and GMM models to study the impact of digitalisation on poverty levels in Zimbabwean provinces. The post-estimation diagnostic tests, which include Arellano Bond serial autocorrelation, Wald tests and the Sargan test, will then be interpreted by the researcher.

4.5.1.2 Fixed Effects Model

A fixed effects model is a statistical model in which the model parameters are fixed or non-random quantities. This is in contrast to random effects models and mixed models in which all or some of the model parameters are random variables. This model's estimation is based on assumptions about the intercept, slope coefficients, and error term. This model can be used for estimating in a variety of ways. The model assumes that the intercept and slope coefficients are consistent throughout time and space, that the error term represents variations over time and between people, and that the slope coefficients are constant, but the intercept varies between individuals.

By allowing each province to have its unique intercept, the model allows for heterogeneity or distinctiveness among cross-section units (provinces). The term "fixed effects" refers to the fact that the intercept does not change over time, despite differences between firms. This indicates that the Fixed Effects Model (FEM) allows for the correlation of individual-specific effects i with the regressor Xi over time.

Panel units have a different intercept term but the same slope parameters. The fixed-effects model is therefore theoretically given as shown by equation 4.2 which is:

$Y_{it} = \alpha_i + X_{it} + \mu_{it}$……(4.2)

According to Gujarati (2003), FEM deals with the omitted variables problem, such as bias and variance inefficiency, which affects either the REM or OLS estimators. The poverty was considered the dependent variable, whereas the other variables indicated in were considered independent variables. Individual regressions will be run to ensure that the exact effects will be well captured for the identified variables. Equation 4.3 shows the standard regression which will be run in this study:

$IWI_{it} = \beta_1 + \sum_{j=2}^{k} \beta j X jit + Uit$ ……..(4.3)

Where i = 1, 2, 3 …N (provinces in Zimbabwe)

and j = 1, 2, 3 … T (years)

Whereby i represents the *i*-th cross-sectional unit and *t* stands for the time period. n stands for β_1 intercept in this study and represents the slope coefficient, and IWI is the poverty rate for each province in Zimbabwe, while Xj_{it} represents the exogenous factors $X_1 \ldots n$, U_{it} is the stochastic error term

4.5.1.3 Random Effects Model

Gujarati (2018) stipulated that a random effects model, also called a variance components model, is a statistical model where the model parameters are random variables The Random Effects Model (REM) assumes that individual-specific effects (αi) are distributed independently of the regressor. The αi is included in the error term. Each individual has the same slope parameters and a composite error term of the form shown by equation 9.

$$\mathcal{E}_{it} = \alpha_i + e_{it} \ldots\ldots\ldots\

The GMM model will aid in the estimate of model parameters, and so will contribute to the study's fourth empirical research objective, which is to evaluate the effect of digitalization on poverty in Zimbabwe (Tripathi, 2011; Bennet, Kallus & Schnabel, 2019). Secondary data provided from Global Data Labs and the World Bank span a period of 15 years, which is less than 30 years, making a generalised method of moments (GMM) or a systems generalised method of moments (SGMM) appropriate. The GMM estimators are recognised to be the most consistent, asymptotically normal, and efficient of all estimators that do not employ any additional information other than what is provided in the moment conditions. Lars Peter Hansen advocated GMM in 1982 as a generalisation of Karl Pearson's 1894 method of moments. However, these estimators are mathematically identical to those based on "orthogonality conditions" (Sargan, 1958, 1959) or "unbiased estimating equations" (Huber, 1967; Wang et al., 1997). The GMM and the SGMM are to be used via the Arellano-Bond estimator and the Arellano-Bover/Blundel - Bond estimators.

$$Y_{it} = \alpha + \sum \delta_j y_{i-j} + \sum \beta_l x_{i,t-l} + \sum y_k z_{i,t-k} + u_{it} \quad \text{.....(4.7)}$$

Where the causality-based variables x and y are digitalisation or poverty respectively. The study will make use of major control variables (z) as mediators between digitalisation and poverty which including education, health, household size, house quality, urbanization, electricity and asset ownership.

In equation (4.7); t = 1 ,…., T is time and i = 1,...N is cross section and m , n and r are the number of lags. It is assumed that the it u follow a one-way error component model:

$$u_{it} = \mu_i + \lambda_t + v_{it} \quad \text{.....(4.8)}$$

Where $\mu_i \sim$ IID (0, $\sigma^2\mu$) is the unobserved province-specific effect, (2) $\lambda_t \sim$ IID (0,σ^2_λ) represents period specific effects and $v_{it} \sim$ IID(0, σ^t_v) the error term. The dynamic panel data regressions described in (4.7) and (4.8) are characterized by two sources of persistence over time, autocorrelation due to the presence of a lagged dependent variable among the regressors and μi ndividual effects characterizing the heterogeneity among the individuals. Since it y_{it} is a function of μ_i, it follows that $y_{i,t-1}$ is also a function of μi. Therefore, $y_{i,t-1}$, a right-hand regressor in (1) is correlated with the error term. This renders the OLS estimator biased and inconsistent even if it v are not serially correlated.

Arellano and Bond (1991) introduced a dynamic panel General Method of Moments (GMM) estimator, which is an instrument variable estimator that incorporates all previous values of endogenous regressors as well as current values of strictly exogenous regressors as instruments,

to address the aforementioned difficulty. Estimates can be calculated using either the first difference or the orthogonal deviations. Arellano- Bond estimation begins by changing all regressors, typically by differencing, and employs the Generalised Method of Moments, which is why it is known as Difference GMM. The Arellano-Bover/Blundell-Bond estimator extends Arellano-Bond by assuming that first differences in instrument variables are uncorrelated with fixed effects. This enables the addition of more instruments, which can significantly improve efficiency. System GMM is created by constructing a system of two equations: the original equation and the altered one. It is preferable to utilise difference GMM because it addresses the finite sample bias problem created by weak instruments in first differenced GMM. It also provides forward orthogonal deviations, a differencing alternative that preserves sample size in panels with gaps. It also provides for more precise control over the instrument matrix. Arellano and Bond proposed two estimators: one- and two-step estimator, with the two-step estimator being the optimal estimator. The Sargan/Hansen test of over-identifying restrictions is to be performed, which is a joint test of model specification and appropriateness of the instrument. The Wald chi square /F ratio test for join significance for the model, can also be a complement to the post-tests of the GMM.

4.5.2 Hypotheses

The main hypothesis addressing the research topic and the main objective is as follows:

> H_0 = **(Null Hypothesis):** There is no relationship between digitalisation and poverty in Zimbabwe
>
> H_1 = **(Alternative Hypothesis):** There is a relationship between digitalisation and poverty in Zimbabwe

The following hypothesis was used for the third objective.

> H_0 = **(Null Hypothesis)**: There is no causal-effect between digitalisation and poverty.
>
> H_1 = **(Alternative Hypothesis**): There is a causal--effect between digitalisation and poverty.

The following hypothesis was used for the fourth objective.

> H_0 = **(Null Hypothesis)**: Digitalisation has an effect on poverty.
>
> H_1 = **(Alternative Hypothesis**): Digitalisation does not have an effect on poverty

However, the second objective will be resolved using the stylized fact analysis for Zimbabwe provinces and the third objective will be resolved through Dimitrescu-Hurlin Causality Tests while the forth objective will be resolved by a GMM/SGMM model and analysis in answering it.

4.5.3 Objectives and empirical expediting

The Table 4.1 shows how the empirical objectives are to be expedited in this study.

Table 4.2 Objectives and empirical expeditions

Objective	**How it is empirically expedited**
1. To establish the relationship between digitalisation and poverty dimensions in Zimbabwe	Correlation analysis
2.To present the status quo of digitalisation and poverty in Zimbabwe's provinces	Stylized facts presentation, as presented fully in Chapter 5 of the research
3.To investigate the causal relationship that exists between digitalisation and poverty in Zimbabwe	Dumitrescu-Hurlin causality test
4. To evaluate the effect of digitalisation on poverty in Zimbabwe	GMM/SGMM coefficient analysis

Source: Researcher's constructs

Table 4.1 sums up how the study is going to expedite the four objectives suggested in Chapter 1. The first objective, which inquires on the relationship between the key variables, poverty and digitalisation, as well as amongst all other variables, is analysed using the correlation analysis. The correlation analysis focuses on checking associations between the variables, strength and direction.

The second objective, which seeks to fetch the status quo of digitalisation and poverty in Zimbabwe, is expedited by use of a panorama of stylized facts. Graphs and tables are handy, as the descriptive affairs of the variables are explored for the period from 2006 to 2019.

In terms of Objective Three, which inquires if there is a causal relationship between poverty and digitalisation, a Dumitrescu-Hurlin causality test resolves that. The nature of the data, that is panel, is best tested using Dumitrescu-Hurlin causality test, as opposed to Granger-causality which is used for mostly time-series data.

The fourth objective, which points to effect of digitalisation on poverty, is best expedited by using the GMM models. The GMM model is best suited because the data span period is only 15 years, which is less than 30, and because GMM is robust to outliers, and its use of the dynamic trend where lagged phenomenon is included in the model, means that density and clustering aspects can be explored.

4.6 ECONOMETRIC METHODS OF ANALYSIS

Chernyshov and Jharko (2016) posit that an econometric model is a representation of the basic features of an economic phenomenon. The data which was extracted from the World Bank, Global Data Labs 7.0 and Global Data Labs 4.2.1 is thus processed and analyzed using the XYZ techniques. The following statistical methods will be used on the empirical data sets:

- Descriptive analysis
- Panel Regression analysis
- Significance tests

For Objective One, the following model will be used:

$IWI_{it} = \beta_1 it + \beta_2 DIG_{it} + \beta_3 EDU_{it} + \beta_4 HEA_{it} + \beta_5 HHSE_{it} + \beta_6 ELEC_{it} + B_7 ASSET_{it} + B_8 URB_{it} + \beta_9 HSEQ_{it-} + \varepsilon_{it}$ .....(4.9)

$$IWI_{it} = \begin{cases} Poorest = iwi35 \\ Poorer = iwi50 \\ Poor = iwi70 \\ Poor\ (index) = IWI \end{cases} \quad \text{..... (4.10)}$$

$DIG_{it} = \beta_1 + \beta_2 COMP_{it} + \beta_3 INT_{it} + \beta_4 CELLP_{it} + \beta_5 TV_{it} + \varepsilon_{it}$.....(4.11)

$ASSET_{it} = \beta_1 + \beta_2 MOT_{it} + \beta_3 REF_{it} + \varepsilon_{it}$ .....(4.12)

Where IWI is the proxy for the poverty dimension measurement. The *i* on the intercept represents the intercept across provinces in Zimbabwe. β_2 to β_9 are coefficients of the independent variables. ε_{it} is the error term of the model. The independent variables are represented as DIG for digitalisation, EDU for education, HEA for health, HHSE for household size, ELE for electricity, ASSET for asset ownership, URB for urbanisation and HSEQ is for quality of the house. The empirical analysis used is panel data from 2006 to 2020: the subscript *i* represents the cross-sectional component and the subscript *t* represents the time-series component. Digitalisation is a composite index obtained through principal component analysis of the internet (INTR), cell-phone (CELLP) and computer (COMP), while the asset is a

composite index obtained through principal component analysis of refrigeration (REF) and motorbike (MOT).

Poverty is a condition in which fundamental human necessities such as food, safe drinking water, sanitation, health, shelter, education and information are significantly deficient (United Nations Global Impact, 2021). In this study, the international wealth index is utilized to proxy poverty. Cheng *et al.* (2022), and Woolard et al (2022) all agreed in their separate studies that the IWI was strongly correlated to the standard of living portion of the multi-dimensional poverty Index (MPI-SL), the poverty probability index (PPI), the absolute wealth estimate (AWE) and the Demographic House Index (DHS) wealth index, which all predict benchmarks of the socioeconomic position of an economy. The study focuses on investigating the relationship between poverty and digitalisation in the case of Zimbabwe

Digitalisation is the process, use and access of information and communication (ICT) technologies which are in the telecommunication domain. Srai and Lorentz (2019) coined that digitalisation is simply the use of digital technologies. In this study, digitalisation is a composite variable which comprises the internet, cell phone and computers. The data for digitalisation was extracted from World Bank and Global Data Labs 4.2.1. A number of studies have rather used the term ICT, and have also used is as a composite index, for instance Yimaz *et al.* (2018) who investigated the contribution of information and communication technology to poverty reduction using secondary data from 182 countries for the period 2000 to 2013, had ICT utilized as a composite index of internet, mobile, landline and computers. Akinboade et al (2021) discusses access to information and communication technology (ICT) in the context of food security in Soshanguve, in South Africa, and the ICT component comprised cellular phone, television, satellite television, radio, computer and telephone landline. David (2019) did a study which looked into how telecommunications activities affect the economic growth and development of several African nations using 46 African nations in the investigation, which spans the years 2000 to 2015. David's (2019) telecommunication composite index comprised mobile line, fixed/CDM line and Internet access penetration. Yilmaz *et al.* (2018), David (2019) and Akinboade *et al's.* (2021) results have been discussed in the literature.

Education is a very important dimension of poverty, in line with the UNPD (2015). Access to education includes on-schedule enrolment and progression at an appropriate age, regular attendance, learning consistent with national achievement norms, a learning environment that is safe enough to allow learning to take place, and opportunities to learn that are equitably distributed (Lewin, 2015:29). Arsani *et al.* (2020), Qamruzzaman *et al.* (2023) and Liu *et al.* (2023) used education their studies, which related it to poverty. The trio of studies all point out that education has a positive effect in poverty reduction despite their varying approaches

to the core. In this study, education is extracted as an index of the sub-national human development index, and in inculcates access to education from primary, secondary and tertiary levels.

Health index is a variable used in this study. The health component, like education, is regarded as a vital poverty dimension by the UNDP (2015). According to the World Health Organization (WHO, 2020:43) definition, health is *"a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity".* Health development encompasses all the elements that are necessary for the achievement of such a state of being, which in turn results in the being, being capable of participating in production so that the person is taken care of Arsani *et al.* (2020) used this variable and the results showed that there is a strong relationship between health and poverty.

Household size is a population aspect which is crucial when investigating poverty and its causes. Chen *et al.* (2019), Fusco and Islam (2020) and Mdluli and Dunga (2021) utilised the variable *household size* in their studies which they were investigating poverty. The household size has been found to be very important determinants of poverty by these three authors. In this study, the household variable will be utilised as an independent variable, whose relationship with poverty will be sought.

Access to electricity is needed by households for heating and lighting, as much as all industries spanning primary, secondary and tertiary sectors need this important resource. Electricity is important in farming, manufacturing, transport and logistics and literally all spheres of socio-economic life, and the deprivation to access to this resource points to poverty. Diallo and Moussa (2020) and Drago and Gatto (2023) agree that electricity is an important factor affecting poverty. Other studies conceal electricity and identify it as energy, as in Jin and Lalnazov (2023), and will enjoy spanning the research to other forms of energy such as solar energy, coal, nuclear and carbon related fuels.

Asset ownership could not be excluded from such an ordeal where poverty is being investigated in an African set-up, where asset ownership has been a source of wealth since time immemorial, before currency and money came into being. Jackson and Yu (2023) agree that assets ownership are very significant factors affecting poverty. Kabong (2023) voices that asset accumulation is vital for poverty alleviation, and humanitarian organisations who use the approach may assist societies bedevilled by poverty. However, their components of assets may differ with the research at hand, where in this study, motor bike and refrigerators were used as assets.

House quality in the Global Data Labs 4.2.1 meant an array of factors which included access to piped water, floor type, case of household with none or one sleeping room, percentage of cases of households using wood, dung, straw for cooking etcetera. The researcher chose the component of cases of household with none or one sleeping room to indicate this aspect of house quality, the premise being that the data obtainable was too homogeneous so there was no scope of accumulating many indicators as such. Belaïd and Flambard (2023), in their research, do agree that house quality and its related costs does have an impact on poverty. Belaïd and Flambard (2023) interestingly explores house type and family size and found out that they have a great impact on fuel poverty phenomenon and inequality in Egypt.

Urbanization is the number of households who are living in an urban centre within a province in this study. Urbanization affects poverty through many different channels, for example, migration from rural to urban. This migration comes from the wage gap between urban and rural areas. Sakketa (2023) hinted that. when well-managed, urbanisation can play a pivotal role in reducing rural poverty, improving food security and creating opportunities for rural transformation. Rannis and Fei (1976), in their two-sector economy, indicated that urban centres tend to have less poverty than the other sector which is the rural sector. In this study, the relationship between poverty and poverty will be investigated.

4.7 MODEL SPECIFICATION TEST

After crafting the suggested appropriate empirical model, there is a need to test whether the model is sufficient and necessary using a model specification test. The test that evaluates the consistency of an estimator when compared to an alternative, less efficient estimator which is already known to be consistent is the Haussmann test. It helps one evaluate if a statistical model corresponds to the data. To decide between a OLS and FEM and between FEM and REM the researcher is going to run a Haussmann test where the null hypothesis is that the preferred model. It basically tests whether the unique errors are correlated with the regressors, the null hypothesis being that they are not. The tests follow a chi squared distribution with the number of degrees of freedom equal to the rank of matrix $Var(\beta_0) – Var(\beta_1)$.

4.7.1 Redundancy Tests

The redundant variables test compares the original regression with a secondary regression that is identical but for the removal of the test variables. The necessary and sufficient conditions to be derived include a special case of the redundancy of moment conditions for GMM estimation without restrictions and the other GMM estimation with restrictions, Breusch et al. (1999). The GMM without restrictions will be regarded as the original regression and the GMM with restriction will be regarded as secondary regression. The redundancy test will

therefore test the relevance of the secondary GMM regression and diagnose if it is not redundant using the redundancy test, whereby consistency is checked on sample means, sample variance and asymptotic variances. If these are the same, then the secondary GMM will be redundant because the secondary GMM will not be improving efficiency.

4.7.2 Haussmann Tests

The Haussmann test can be used to differentiate between fixed effects and random effects in panel data analysis. In this case, Random effects (RE) is preferred under the null hypothesis due to higher efficiency, while under the alternative Fixed effects (FE) is at least as consistent and thus preferred. To best illustrate reason for the choice, refer to Table 3.4 below.

Table 4.3 Haussmann Test

Choice of Estimator	***H_o* is true**	***H_1* is**
B_1 (RE estimator)	Consistent Efficient	Inconsistent
B_0 (FE estimator)	Consistent Inefficient	Consistent

Source: Researcher's illustrations (2023)

4.8 PRE-ESTIMATION TESTS

The research will involve conducting several pre-estimation tests, as outlined below.

4.8.1 Multicollinearity

Halunga, Orme and Yamagata (2017) purported that multicollinearity tests in panel data are similar to those in cross-sectional or time-series data. Multicollinearity refers to the correlation among independent variables in a regression model. High multicollinearity can lead to unreliable coefficient estimates and inflated standard errors. Multicollinearity will be tested using the variance inflation factor (VIF) and if any variables have a VIF of above 5 they will have to be pruned off, and converting values may also assist. The VIF measures how much the variance of an estimated regression coefficient increases if the predictors are correlated and a high VIF (usually above 10) suggests multicollinearity. However, on correlation matrix, simply examining the correlation matrix of independent variables can give an initial indication of potential multicollinearity.

4.8.2 Heteroscedasticity test

The Breusch-Pagan Test was developed in 1980. This test is used to ascertain heteroscedasticity (Dunga, 2014). The Breusch-Pagan Test assumes that heteroscedasticity may be a linear function of all the independent variables in a model (Halunga, Orme & Yamagata, 2017). The Breusch-Pagan test will be used in this study for the purpose of determining the choice between random effects and fixed effects. Heteroscedasticity assists in checking if data is not spurious which is a statistical problem. The presence of heteroscedasticity in the data will provide an enabling condition for the GMM models to be utilised.

4.8.3 Panel unit root test

Halunga, Orme and Yamagata (2017) indicated that a unit root test tests whether a time series variable is non-stationary and possesses a unit root. The null hypothesis is generally defined as the presence of a unit root, and the alternative hypothesis is either stationarity, trend stationarity or explosive root, depending on the test used. If there are unit roots, the series is not stationary. Accordingly, if the p-value of z(t) is insignificant, the series is not stationary. If $z \leq z0.05$, we reject the null hypothesis H_0 that the series has a unit root. If there are no unit roots, we conclude that the series is stationary. Dickey–Fuller (1979) test can be utilised to test for unit root or stationarity, where the null hypothesis is that a unit root is present in an autoregressive (AR) time series model. Other stationarity test types, which include the Levin-Lin-Chu test, Breitung test, Harris-Tzavalis test and Hadri LM test, are used to be robust in checking for stationarity.

4.9 POST-ESTIMATION TESTS

The research will entail conducting several post-estimation tests, as outlined below:

4.9.1 Wald Test

The Wald test (also known as Wald Chi-Squared Test) is a parametric statistical measure to confirm whether a set of independent variables are collectively 'significant' for a model or not. It is also used for confirming whether each independent variable present in a model is significant or not. The Wald test after Generalized Method of Moments (GMM) model is manipulated serves as a statistical test used to assess the validity of restrictions on the parameters estimated in a GMM framework. GMM is a method of estimation that allows for efficient estimation in the presence of heteroscedasticity and serial correlation. The Wald test helps determine whether a set of linear restrictions on the estimated coefficients is statistically valid.

4.9.2 Sargan/Hansen Test

The Sargan-Hansen test, also known as Sargan's J test, is a statistical test that is used to test for over-identifying limitations in a statistical model. John Denis Sargan proposed it in 1958 and developed many variations in 1975. Lars Peter Hansen went over the derivations again and showed that it can be extended to universal non-linear GMM in a time-series environment. Hansen's J statistic, The Sargan – Hansen test which is used to determine the validity of the overidentifying restrictions in a GMM model. If the model is correctly specified in the sense that E{ziui(β)} = 0, then the sample analog to that condition should hold at the estimated value of β.

4.9.3 Arellano Bond Serial Autocorrelation test

The degree to which the values of the same variables correspond via different measurements in outcomes is termed as autocorrelation (Hajria, Khardani & Rassi, 2018). The Generalised least squares approach will be employed to test for serial correlation. This strategy was chosen in the study because it is considered ideal for estimating the panel regression models (Chetty, 2017).

The Arellano-Bond serial autocorrelation test is used to check for the presence of serial correlation in the residuals of a dynamic panel data model estimated using the Generalized Method of Moments (GMM). This test is particularly relevant when working with panel data to ensure that the model's errors are not correlated over time.

4.10 DEFINITION OF SELECTED VARIABLES

4.10.1 Poverty

Poverty means not having enough to feed and clothe a family, not having a school or clinic to go to, not having the land on which to grow one's food or a job to earn one's living, not having access to credit and being deprived of basic necessities in general. It means insecurity, powerlessness and the exclusion of individuals, households and communities (UNDP, 2020). Poverty measurement is synonymous to measures of the standard of living, which aligns to issues of real gross domestic product/national income, wealthy measurements, human development etcetera. In this study an international wealth index has been chosen to proxy poverty, due to the available data on Global Data Labs for Zimbabwe at provincial level. The World Bank, UNDP, IMF, and other data banks do lack poverty indicators at sub-national or provincial level on Zimbabwe. International Wealth Index (IWI) values are highly correlated with human development, life expectancy, and national income, and IWI-based poverty measures with poverty headcount ratios. Smits (2015) pointed out that, the International Wealth Index, or IWI, is a comparable asset-based wealth

index that can be used to measure the level of material well-being or standard of living of households in low- and middle-income countries. The IWI will be a dependent variable in the model, and it has components of IWI below 70, IWI below 50 and IWI below 35, indicating poor, poorer and poorest categories respectively.

4.10.2 Digitalisation

The digitalisation component has been extracted from unbundling the Asset Ownership aspect of percentage household with computer, as well as extracting items form access to public services which are households with internet. The cell phone was picked from the Global Data Labs 4.2.1 raw data sheet. These information and communication technology aspects also known as digital technologies are the core of this study. A principal component analysis indexing calculation will be used to combine these three digital indicators namely internet, cell phone and computer which is prescribed as digitalisation. Digitalisation is a core independent variable of concern in this study. The assumption is that an increase in digitalisation is to have a positive effect on IWI on the reason that, the more the three components are not deprived, the better the standard of living.

4.10.3 Education

Access to education includes on-time enrollment and progression at the appropriate age, regular attendance, learning that is consistent with national achievement norms, a learning environment that is safe enough to allow learning to take place, and equitably distributed learning opportunities (Lewin, 2015:29). Global Data Labs 4.2.1 presents raw data on mean years of education to populations of various ages, at subnational level, however, the Global Data Labs 7.0 presents an all-encompassing index of the access to educational phenomenon, and that is what has been considered for this research. The educational index will be treated as an independent variable, whose effect to the international wealth index will be positive. That means there is assumed that there is a positive relationship between education and IWI, on the premise that an increase in education may reduce poverty hence increase wealth of a household.

4.10.4 Health

The health index under the Global Data Labs 7.0 has been indexed from a basket of indicators which include, but are not limited to, the stunted growth of children in households, malnutrition, underweight, etcetera. WHO (2020) proposes that health is physical and mental well-being; freedom from disease, pain, or defect; normalcy of physical and mental functions; soundness. When a person is deprived of health, they lack energy, effort and opportunity to participate in

wealth creation activities. That is to say, health is assumed to have a positive relationship with IWI, on the grounds that an increase in access to health and hence healthy person results in the enjoyment of opportunities to participate in wealth creation and hence lower the incidence of being poor.

4.10.5 Household size

The household size is an element of population. The Global Data Labs 4.2.1 presents household size as the average number of family members in a household. Pareto (1935) on the production possibility frontier (PPF) proposition argued that increase in population increases the PPF outwards hence creates more wealth. Malthus (1978) contradicts Pareto (1900)'s proposition, noting that the more the population the more the resources will be dwindled fast, hence an increase in household size may increase the incidence of poverty. In this regard, the relationship between IWI and household size can either be negative or positive.

4.10.6 House quality

The house quality indicator utilised one of the aspects in the basket as per Global Data Labs 4.2.1 data sets, which was cases of small room with no or one sleeping room. As noted in earlier sections, Belaïd and Flambard (2023) do agree that house quality and its related costs does have an impact on poverty. Chapman and Bennet's (2023) study recognized that housing quality is essential for population health and broader well-being. The notion presented by this variable is that the more the cases of this phenomenon on the province, the poorer and less wealthy is the society. In this regard, the assumed sign between IWI and house quality is negative.

4.10.7 Electricity

Electricity is a very important aspect in the discussion of the relationship between IWI and digitalisation. Electricity presents itself as a driver for digitalisation because without power, digital gadgets cannot function, as well as being a driver for wealth creation because for production and manufacturing to take place, energy is required. Abubakar (2022) argued that electricity is the most predictor of poverty in Nigerian households, and of course, the same is assumed for all African countries. As noted in earlier sections, Diallo and Moussa (2020) and Drago and Gatto (2023) agree that electricity is an important factor affecting poverty The expected sign for the relationship between electricity and IWI is slated to be positive. It is without say that, the relationship between electricity and digitalisation will be checked, as an extra offshoot splicing to the digitalisation agenda.

4.10.8 Urbanisation

Urbanisation is the increase in the proportion of people living in towns and cities. Urbanisation occurs because people move from rural areas (countryside) to urban areas (towns and cities) and notably, this has been found to occur when a country is still developing usually, which may result in lowering of the population in the rural while urban populations increase. Ranis and Fei (1963) notably pointed out that this dual economy drift happens when economic growth and development is taking place. Sulaimon (2022) and Ahmed et al (2023) used urbanisation in their respective studies investigating the scope around urbanisation and poverty. In this regard, the assumption is that, urbanisation will have a positive relationship with the international wealth index.

4.10.9 Asset ownership

Asset ownership is the possession and entitlement of some physical and non-physical things that have monetary value and significantly contribute to the social well-being of a household. African household setups have been popular in having domestic animals such as cattle, sheep, goats and land as valuable assets, which can be a source of wealth transferrable from generation to generation (Huy *et al.*, 2023). Modern-day societies value automobiles, household things and property as real wealth, notwithstanding that financial assets are equally significant. In this study, motorbikes and refrigeration are considered as assets, and their consideration was mainly due to the availability of provincial data on Zimbabwe as well as that if a family has potential to have these, it indicates that the wealth potential is increasing. Jackson and Yu (2023) used asset ownership in their study about multidimensional poverty in South Africa. In this regard, the expected sign for the relationship between asset ownership and international wealth index is positive.

Table 4.4 Summary of variables and expected signs

Variable	Expected Sign	Symbol	Description	Source of Data
Poverty	Dependent Variable	IWI	A state in which basic human needs, such as food, safe drinking water, sanitation, health, shelter, education, and information are severely deprived. This is measured through IWI.	Global Data Labs 4.2.1 (2023)
Digitalisation	+	DIG	Principal component value of access to internet, mobile phones and computers	World Bank (2023) and Global Data Labs 4.2.1 (2023)

Education	+	EDU	Index value of access to education at all levels	Global Data Labs 7.0 (2023)
Health	+	HEA	Index value for access to health care services	Global Data Labs 7.0 (2023)
Household size	+ / -	HHSE	The average number of family members in a household per province	Global Data Labs 4.2.1 (2023)
Asset ownership	+	ASSET	The assets owned by a household in the province. It is measured as a principal component of percentage of ownership of a motorbike and a refrigerator per household in a province	Global Data Labs 4.2.1 (2023)
House quality	-	HSEQ	The quality of the house is depicted by percentage of cases of households who have no or have one sleeping room per province	Global Data Labs 4.2.1 (2023)
Urbanization	+	URB	The percentage of population living in urban areas in region per province	Global Data Labs 4.2.1 (2023)
Electricity	+	ELE	The percentage of households who have access to electricity	Global Data Labs 4.2.1 (2023)

Source: Researcher's own Illustrations (2023)

4.11 NATURE OF DATA AND SOURCES

The data to be utilised in this study was extracted from the World Bank, the Global Data Labs 4.2.1 and Global Data labs 7.0. The grounds for choosing the Global Data Labs data was that it is the affordable source which presented subnational data for Zimbabwe at provincial level, for the variables of interest such as the digitalisation components computer and cell phone. The internet variable was manipulated using yearly data from World bank then adjusted using location coefficient indexing with data from Global Data Labs 4.2.1. The time-series of the data trend is from 2006 to 2020. The premise of this time span is because there were missing values in the period before 2006 which could not be interpolated, as they were producing negative values if attempted. The time-frame was justified because it allowed for meaningful and balanced data analysis and drawing of conclusions on the subject matter. Digitalisation in this research is based on the composite index of access to internet, cell phone and computer while poverty is represented by the international wealth index, which exposes the poor, poorer and poorest categories too.

Other independent variables utilised are education, health, electricity, household size, asset ownership, urbanization and house quality. Panel data was chosen in this study because there was need to ascertain the change in movement on the key variables in question i.e. digitalisation and poverty. Other factors included in the study were dealt with when running the panel data. This implies that the main interest was in assessing how digitalisation is related to poverty in the provinces of Zimbabwe. Another key merit to using panel data was that pooled data enabled the researcher to carry out studies on complex behavioural models.

4.12 CHAPTER CONCLUSION

This chapter presented the methods utilized to address the research topic, which is to analyse the relationship between digitalisation and poverty in the ten provinces of Zimbabwe, namely Harare, Bulawayo, Manicaland, Mashonaland East, Mashonaland West, Mashonaland Central, Matebeleland North, Matebeleland South, Masvingo and Midlands. A positivism research philosophy was adopted, which accommodates large quantitative samples, which is in this research. A quantitative research design was suggested for this study since all study observations are operationalized as numerals. Sen's (1995) theoretical framework, in cohort with Stiglitz-Sen-Fitoussi (2009), was the foundation of the conceptual framework crafted in this study, where the determinants of poverty (digitalisation, education, health, household size, house quality, electricity and asset ownership) are to be investigated in terms of their relationship with poverty as proxied by the international wealth index (IWI).

The panel ordinary least squares (OLS) model to be used in the correlation analysis between poverty and the poverty dimensions was expressed, as well as the Dumitrescu-Hurlin test for causality. The impact models expressed are OLS, the fixed and random effect models, as well as GMM. The generalized methods of moments, and its dynamic nature was proposed and explained, as well as the first and second step premises towards obtaining the optimistic exposition displaying the relationship between digitalisation and poverty in Zimbabwe provinces. An array of pre-estimation diagnostic tests such as multicollinearity, stationary and heteroscedastic test were explained as much as the post-model diagnostic test such as the Sargan tests, Wald tests and Arellano Bond Serial Auto correlation test. The chapter wrapped up by expounding on definitions of variables, expected signs, as well as the nature of data sources. The methodology chapter discussed thoroughly how the four objectives of the study are to be expedited. The following chapter is based on a presentation of stylized facts.

CHAPTER 5: STYLISED FACT ANALYSIS ON ZIMBABWE

5.1 INTRODUCTION

This chapter presents stylised facts analysis in line with the methodology presented in the previous chapter. The stylised facts focus on the key variables included in this study, namely poverty, digitalisation, education, health, household size, urbanisation, asset ownership, house quality and electricity. Poverty and its components, which are the international wealth index (IWI) for three categories, namely the poor (IWI below 70), poorer (IWI below 50) and poorest (IWI below 35), are to be discussed in the context of Zimbabwe.

The digitalisation variable in this study is a composite component comprising computers, internet and cell-phone, to be aggregated using the principal component analysis. Asset ownership is an index comprising two components, namely motorbike and fridge, while house quality will comprise piped house size and floor type. The variable to be deliberated too are health, education, and access to electricity. This chapter will have a discussion ON digitalisation and poverty trends in Zimbabwe from 2006 up to 2020, which is the scope of the study. The main research purpose is to investigate the relationship between poverty and digitalisation in Zimbabwe, using a provincial approach.

5.2 POVERTY (IWI)

Smit and Steendijk (2015) asserted that the International Wealth Index (IWI) is an asset-based index of a household's material well-being, or economic status, that can be used to measure poverty in low- and middle-income countries. It goes without saying that the National IWI values are highly correlated with human development, life expectancy, and national income, and that IWI-based poverty measures are aligned to poverty headcount ratios (Smit & Steendijk, 2015). It is in this regard that this research utilized the IWI as a measure of poverty.

Figure 5.1 shows details about the poverty index at the provincial level as measured by the international wealth index (IWI) for the period 2006 to 2020. The reason for choosing this period is based on the availability of data on Global Data Labs, whereby any extrapolation backwards was impossible. The period coincides with high levels of ICT usage in Zimbabwe (Zimstat, 2020). The results show that the metropolitan province of Bulawayo has the highest poverty index of 72.14, followed by the metropolitan provinces of Harare with 63.227. Matebeleland North had the least poverty index of 27.36, followed by Mashonaland Central which had the second lowest poverty index of 30.8525. The rest of the provinces have a poverty index between 31 and 36. The detail from Figure 5.1 shows that the ten provinces of Zimbabwe have high poverty rates as measured by the average national poverty index (IWI)

in the period under consideration. Zimbabwe has an average IWI of 40.83, and the data shows that only two provinces are above the national average poverty index, which are the metropolitan provinces of Harare at 63.227 and Bulawayo at 72.1425. This indicates that wealthy households are concentrated in cities, which is agreeable to Ranis and Fei (1964) on the dual economy where the rural re poorer than the urban based ones. Naveed *et al.* (2021), Woolard *et al*. (2022), and Managi *et al.* (2023) have used IWI in their poverty cantered studies.

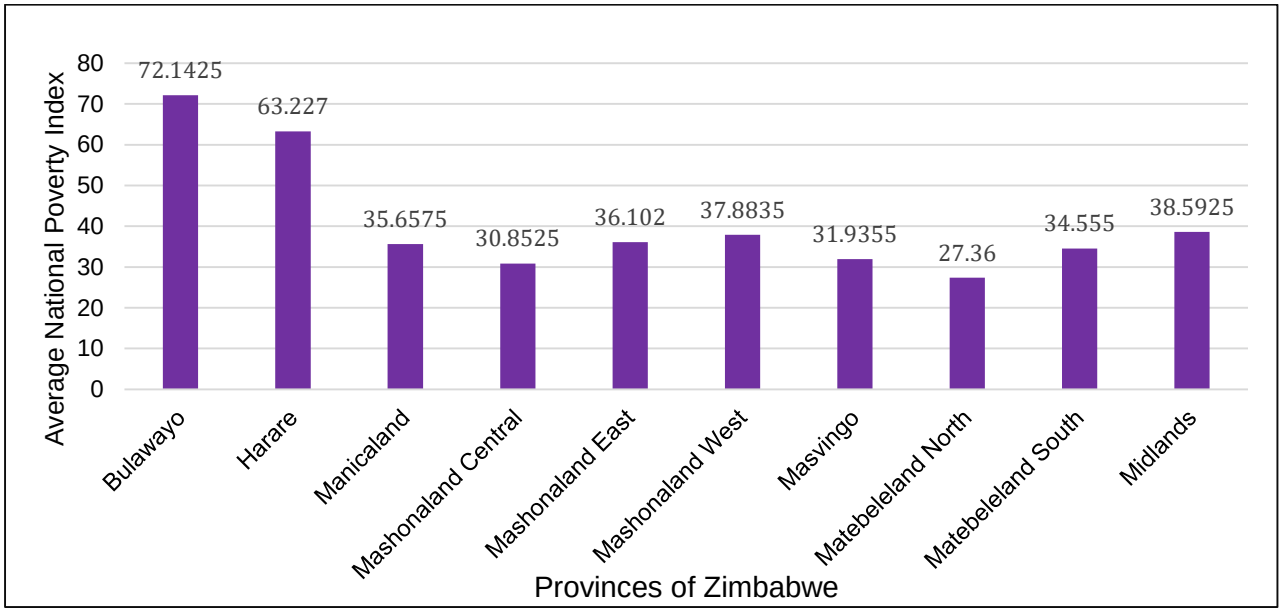

Figure 5.1. Average National Poverty Index of Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

However, it is also vital to expose the categories of IWI in terms of who is poor, poorer and poorest in these provinces. To expose these categories, the following sections present poor households with IWI of less than 70; poorer household with IWI of less than 50; and poorest households with an IWI of less than 35, all at provincial level.

5.2.1 Poverty Trend in Zimbabwe from 2006 to 2020

This study is utilizing the international wealth index (IWI) to gauge the poverty in the case of Zimbabwe from 2006 to 2020. Figure 5.2 shows the trend in the national IWI from 2006 to 2020, as extracted from Global Data Labs 4.2.1 (2023). The results show that wealth index in Zimbabwe has been cascading downwards steeply from 2006 up to 2016, dropping from an all-time high of around 63 to around 48 by 2015. This shows that the households in Zimbabwe were continuously drowning in the sordid waters of poverty. From 2015, the trend shows some hope of positive increase, although the increase was at a very gradual pace till 2020, where the scope of the study limits.

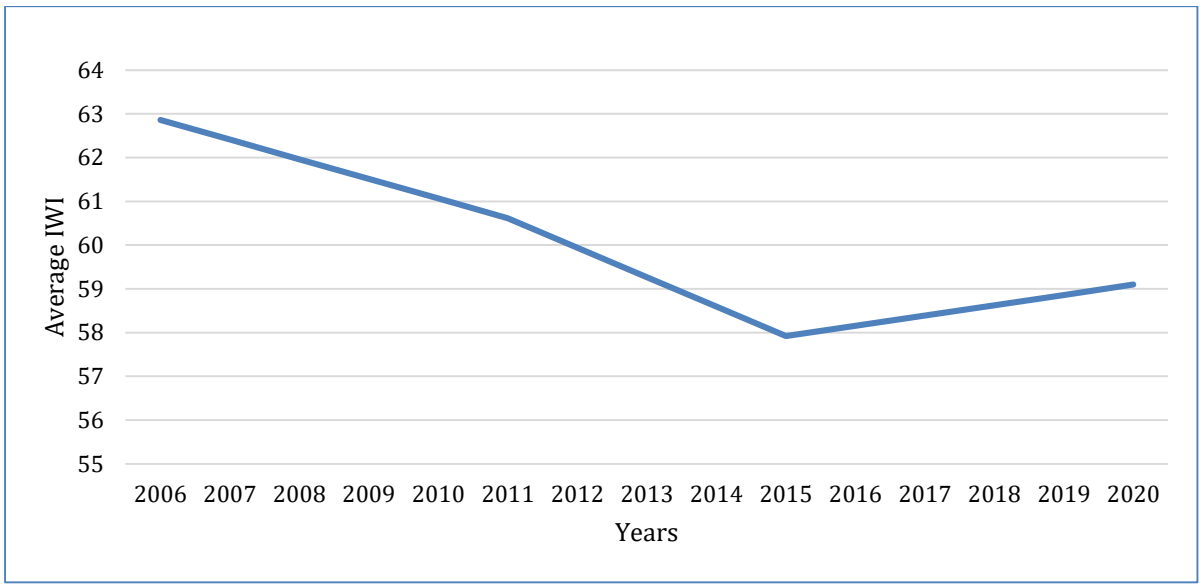

Figure 5.2: International Wealth Index of Zimbabwe Provinces from 2006 to 2020
Source: Researcher's calculations (2023)

The overall picture of the trend on average shows a decline in the wealth index from around 63 in 2006 to around 59 in 2020, which indicates that poverty has been creeping into the households of Zimbabwe. The research seeks to find out if this trend in poverty is associated in any way with digitalisation. Nyandoro and Hatti (2019) and Mutanda (2023) in their separate studies all pointed to an increase in poverty in Zimbabwe post 2000, although they harnessed other facets such as politics and institutional integrity in their analysis. The UNDP (2023) has also indicated that the majority of Zimbabweans live in severe multi-dimensional poverty.

5.2.2 Poor Households (IWI < 70)

Smits and Steendijk (2015) posited the International Wealth Index (IWI) as the first comparable asset-based assessment of a household's material well-being, or economic status, that can be applied in all low and middle-income nations. The advantage of IWI is that it can be packaged to align poor, poorer and poorest households. This section will present the poor households who have an IWI of less than 70 in the Zimbabwean Provinces, as illustrated by Figure 5.3

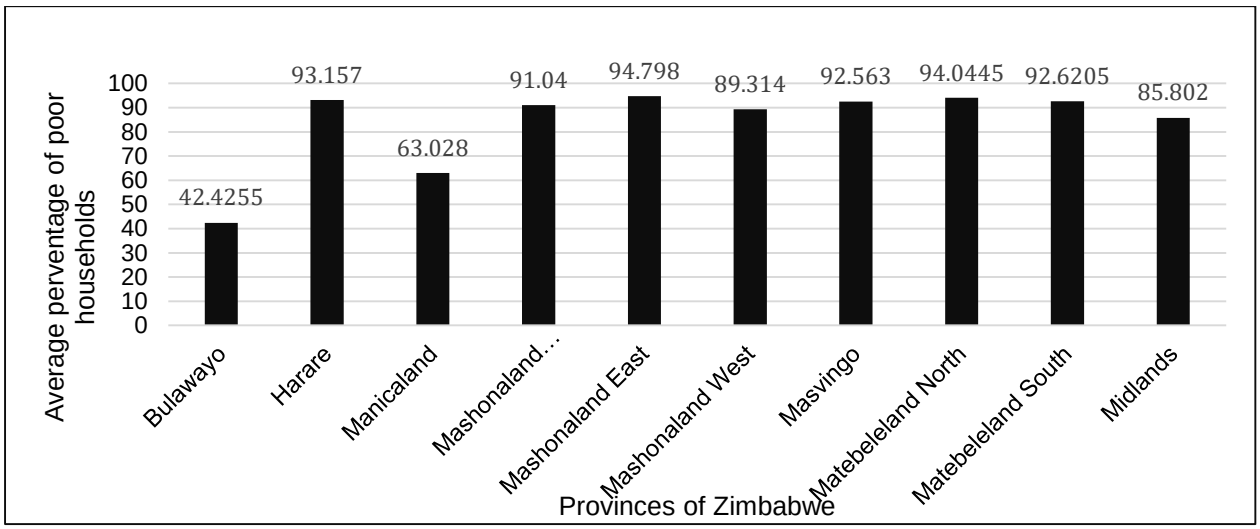

Figure 5.3: Average Percentage of poor households with IWI<70 of Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

Figure 5.3 shows poverty as measured by the average international wealth index of households which are below an index of 70. Figure 5.3 shows that most of the provinces of Zimbabwe had a fairly high rate of poverty between 2006 and 2020. Bulawayo had an exceptionally lowest average percentage of poor households followed by Manicaland for the period 2006 to 2020. The empirical results show that there is generally high average poverty indicated by an IWI of less than 70 in Zimbabwe for the period under consideration.

5.2.3 Poorer Households (IWI < 50)

Figure 5.4 presents the average international wealth index of poorer households which are below an index of 50 across the ten provinces of Zimbabwe. There is generally a high average IWI of less than 50, with the highest being Mashonaland East, Matebeleland North and Harare. The least are Bulawayo followed by Manicaland in the period under review, which is 2006 to 2020. The picture shows that on average, most provinces have poorer households with an IWI of less than 50.

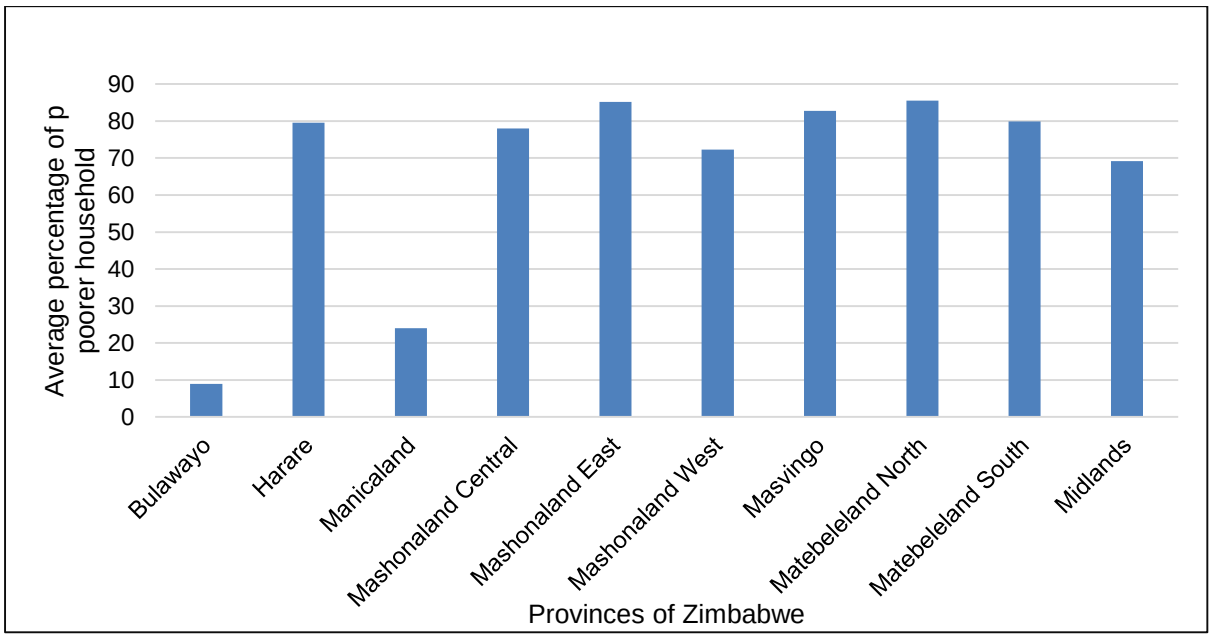

Figure 5.4: Average percentage of poorer households with IWI<50 of Zimbabwe Provinces (2006 to 2020)

Source: Researcher's calculations (2023)

5.2.4 Poorest Households (IWI < 35)

Poorest households are aligned to an IWI of less than 35, as shown in Figure 5.5. The detail shows that most provinces have poorest households with the exception of Bulawayo and Manicaland, as presented below. The poorest province is Matebeleland North at 70 of poorest households, followed by Mashonaland East with approximately (64%) of households falling into the poorest category. Metropolitan provinces of Bulawayo and Harare have low rates of poorest household, at (1.26%) and (7.08%) respectively. Most of the provinces have percentage rates of poorest households above (45%), which shows that poorest households are prevailing in Zimbabwe.

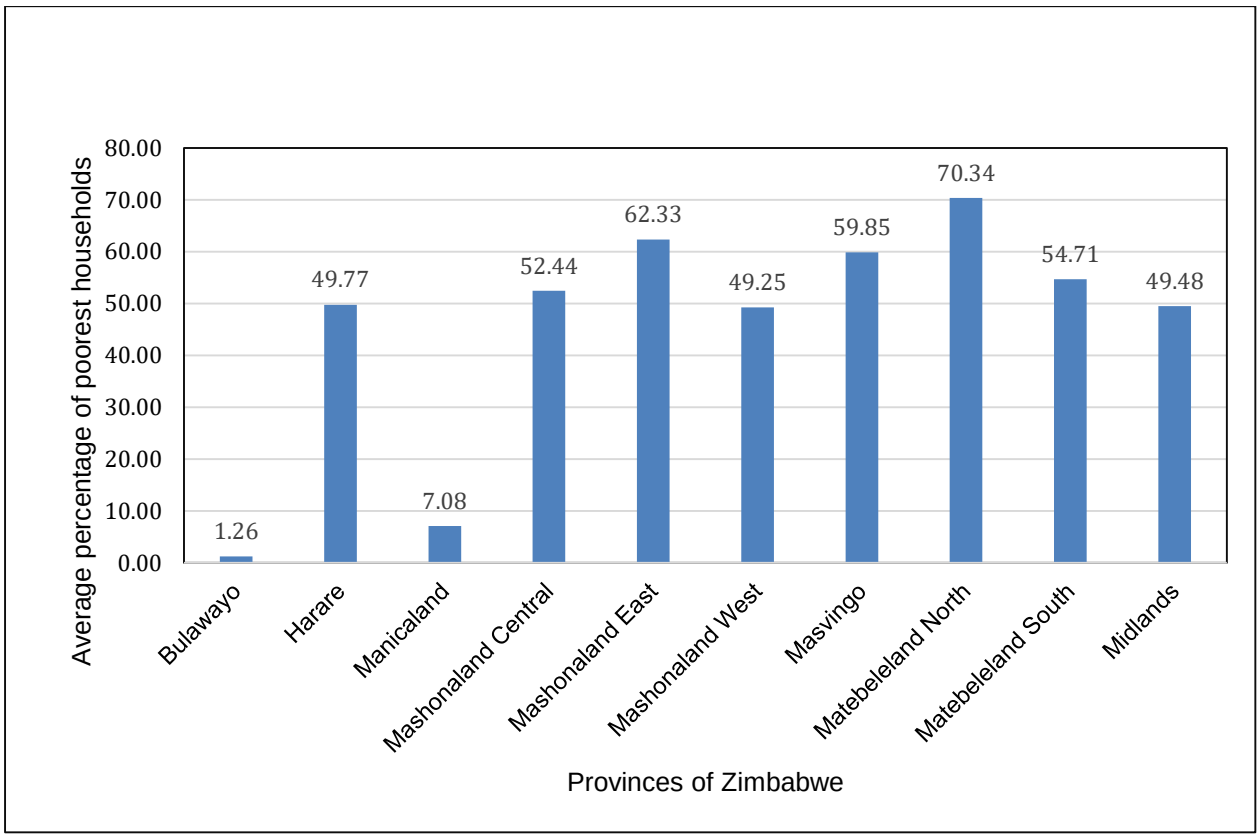

Figure 5.5. Average percentage of Poorest households with IWI<35 for Zimbabwe Provinces, 2006 to 2020

Source: Researcher's calculations (2023)

5.3 DIGITALISATION

The digitalisation variable in this research is a composite index of internet, computer and cell-phone. However, in this section of stylized fact analysis, the digitalization composite index is to be described first, followed by unpacking the individual aggregates and analysing them accordingly to present their facts as is.

5.3.1 Digitalisation Composite Index

To investigate the impact of digitalisation on poverty, a composite index of digitalisation is used which comprises of access to internet, access to cell-phone and access to computer. These can be expressed algebraically as follows:

$$\text{Digitalisation} = \beta_0 + \beta_1 \text{internet} + \beta_2 \text{Cell phone} + \beta_3 \text{Computer} + + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots \quad (5.1)$$

Figure 5.6 shows details about the digitalisation composite index in the ten provinces of Zimbabwe for the period spanning 2006 to 2020. Using a combined index of the average of the four components of digitalisation outlined earlier, Harare has the highest digitalisation

index at 50.16, followed by Bulawayo with 49.56. Matebeleland North has the lowest digital uptake of 20.60, followed by Mashonaland Central with 24.09. The average digitalisation index of all provinces is at 38.30. This means that only two provinces are above the average digital index of the ten provinces, while 8 provinces have digital uptake indices which are less than the national average one.

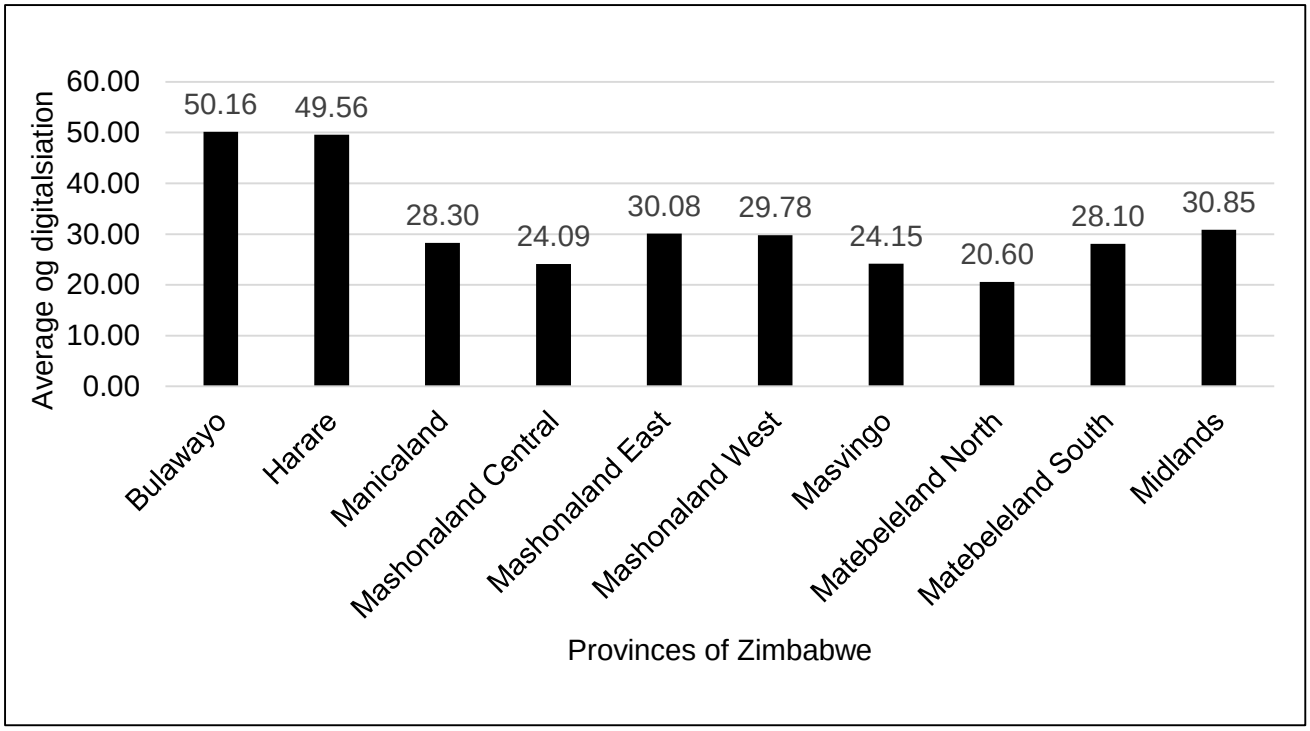

Figure 5.6. Average digitalisation composite index for Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

5.3.2 Ranking of digitalization in the provinces of Zimbabwe

To unpack digitalisation, the following rankings have been presented in Table 5.1. The rankings are based on the indices of internet, cell-phone and computer.

Table 5.1: Ranking of digitalisation in Zimbabwe provinces from 2006 to 2020

	Internet		Computer		Cell phone	
Province	**Index**	**Rank**	**Index**	**Rank**	**Index**	**Rank**
Bulawayo	19.4	3	83.17	2	16.03	2
Harare	22.74	1	83.23	1	17.27	1
Manicaland	15.97	5	60.21	7	4.79	6
Mashonaland Central	7.89	9	55.05	9	2.77	10
Mashonaland East	19.8	2	63.31	3	4.99	5
Mashonaland West	10.44	7	62.77	5	5.84	4
Masvingo	8.77	8	59.4	8	4.27	8
Matebeleland North	3.66	10	51.95	10	3.64	9
Matebeleland South	17.74	4	61.56	6	4.78	7
Midlands	15.78	6	62.95	4	6.21	3

Source: Researcher's calculations (2023)

Table 5.1 shows that in terms of the internet, the top three performing provinces are Harare, Mashonaland East and Bulawayo. The worst performing provinces in terms of internet penetration are Matebeleland North at the lowest end, followed by Mashonaland Central and third from last is Masvingo. In terms of cell-phone penetration, the best performing province is Harare, followed by Bulawayo and the third being Mashonaland East. The worst performers in terms of cell-phone are Matebeleland North followed by Mashonaland Central.

The evidence on digitalisation rankings indicates that Harare is leading in computer adoption, followed closely by Bulawayo. On the other hand, Mashonaland Central and Matebeleland North are the least successful in terms of computer uptake. In summary, Harare and Bulawayo, as metropolitan provinces, are the frontrunners in digital uptake, excelling in computer adoption. Meanwhile, Matebeleland North and Masvingo face challenges in keeping up with digitalization trends, ranking lower in computer uptake.

5.3.3 Digitalisation Trend in Zimbabwe (2006 to 2020)

The digitalisation composite index trend in Zimbabwe shows a gradual increase from 2006 at 10 up to 50 as shown in Figure 5.7. This trend reflects truly what is on the ground, given a surge in cell-phone use by almost every household, which previously had no access to the traditional telephone. Dhliwayo and Jita (2023) conformed that ICT, especially on internet and cell-phone, are on an increase in Zimbabwe. POTRAZ (2020) stated that the mobile money success has been enabled by the boom in the use of mobile cell-phone subscriptions.

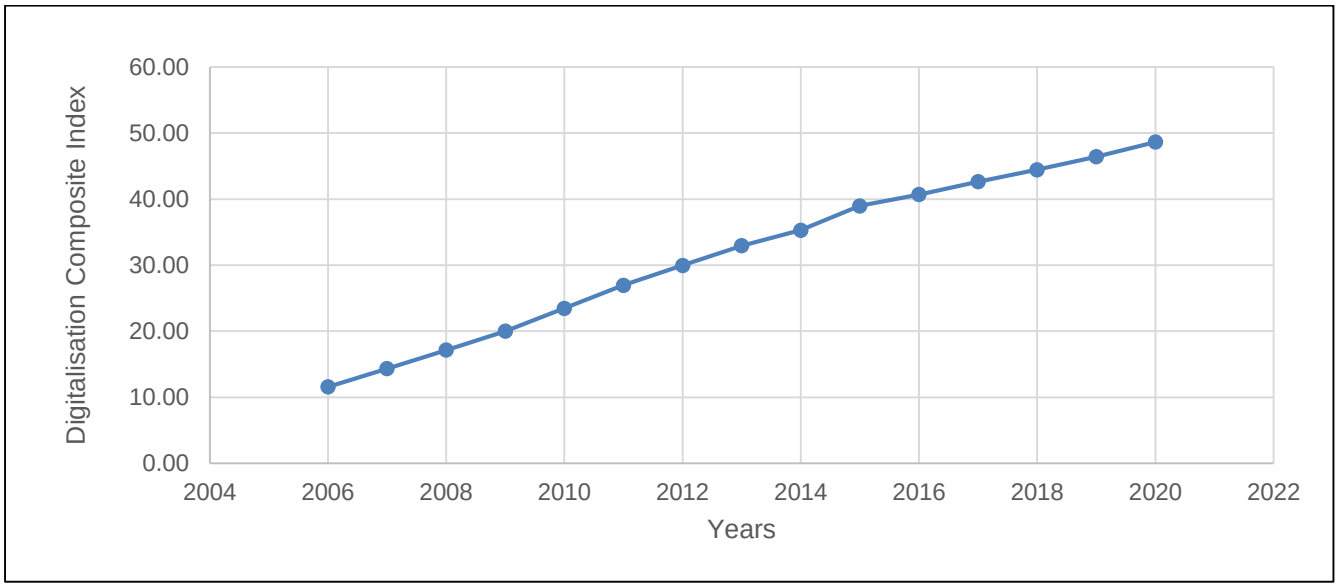

Figure 5.7: Ranking of digitalisation in Zimbabwe provinces from 2006 to 2020

Source: Researcher's calculations (2023)

5.3.4 Internet

Internet penetration data on a yearly national basis was extracted from World Bank while the provincial one was extracted from Global Data Labs 4.2.1. The provincial data from Global Data Labs 4.2.1 was indexed using the differencing indexing approach, then applied to the time-series yearly data from the World Bank for the years 2006 to 2020. Figure 5.8 below shows that there is fairly high internet penetration in six of the ten provinces of Zimbabwe in the period under consideration. Harare has the highest average internet penetration at (22.7%), followed by Mashonaland East with (19.80%), Bulawayo at (19.40%) and Matebeleland South with 17.74 %). The provinces with the lowest average internet penetration are Matebeleland North with (3.66%), followed by Mashonaland Central with (7.89%). Internet penetration is very important in enhancing communication, movement of documentation, research and knowledge as well as data analysis, entertainment and participation on social platforms. The provinces with low internet are assumed to have high poverty rates in line with propositions forwarded in the empirical literature review where low rates of internet usage are

associated with high poverty rates. However, further econometric manipulation of the relationship will present better and finer details on the nature of relationship, whether it extends from short-run to long-run phenomena, so that appropriate policies can be put in place.

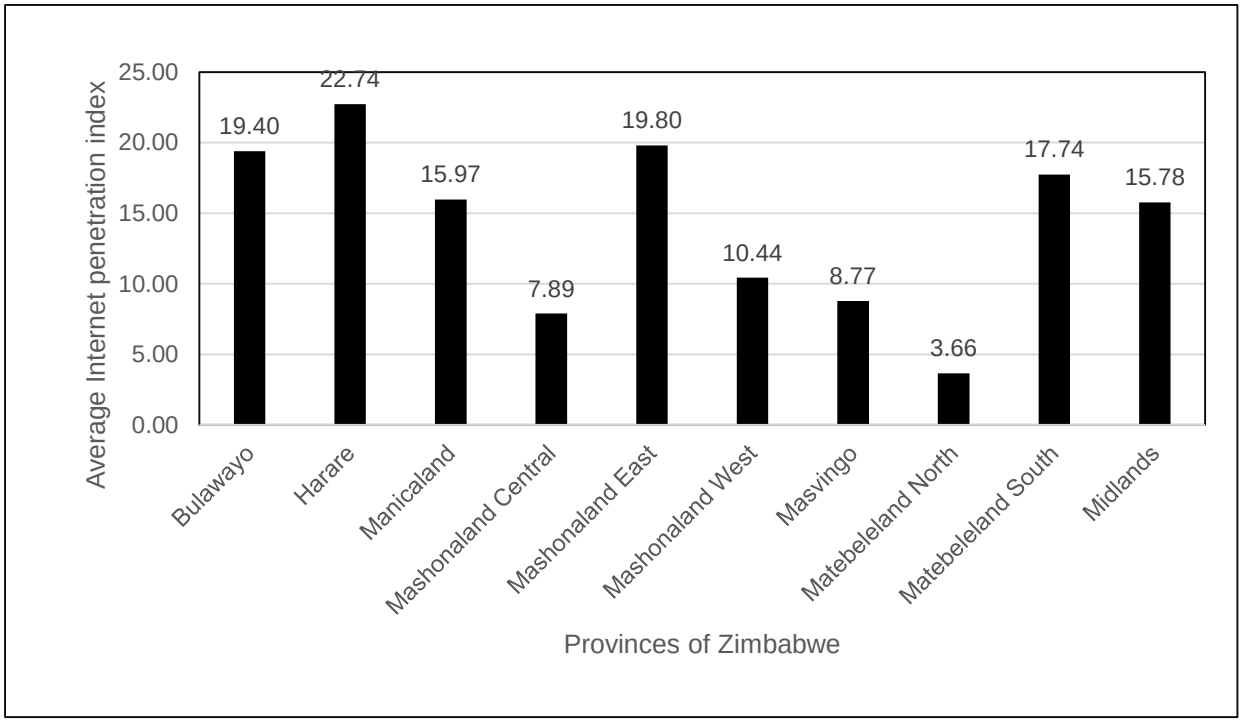

Figure 5.8. Average percentage of internet penetration per households in Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

5.3.5 Cell-phone penetration

The data from Global Data Labs 4.2.1 on Zimbabwe, pointed that cell phone penetration is presented as the percentage of households with a cell-phone shows the average percentage of cell phone penetration per household in the ten provinces of Zimbabwe. The data shows that Harare and Bulawayo have the highest average cell phone penetration per household of (83.23%) and (83.17%) respectively, which means that almost every household in Harare and in Bulawayo has a cell phone. This reflects reality, as cell phones the capital city of Zimbabwe followed by Bulawayo, which is the second capital city and the cell phone technology is more of a need requirement for every economic agent for purposes of making communications in the form of voice calls, short messages services (SMS), WhatsApp, Facebook, games, camera, videos, audios, acts as watch, storage for documents, memories, and various other aspects which urbanites deem necessary. The data shows that most provinces have high cell phone penetration, which reflects that cell phone upsell phoney in all provinces of Zimbabwe. The outsell phonehenomenon is that, despite high cell phone penetration, poverty is

Zimbabwe is high as reflected by the phenomenon, which purported that all provinces of Zimbabwe are poor at IWI<70 as reflected in Figure 5.3. The research will further provide finer details about the relationship between digitalisation and poverty using econometric panel data analysis.

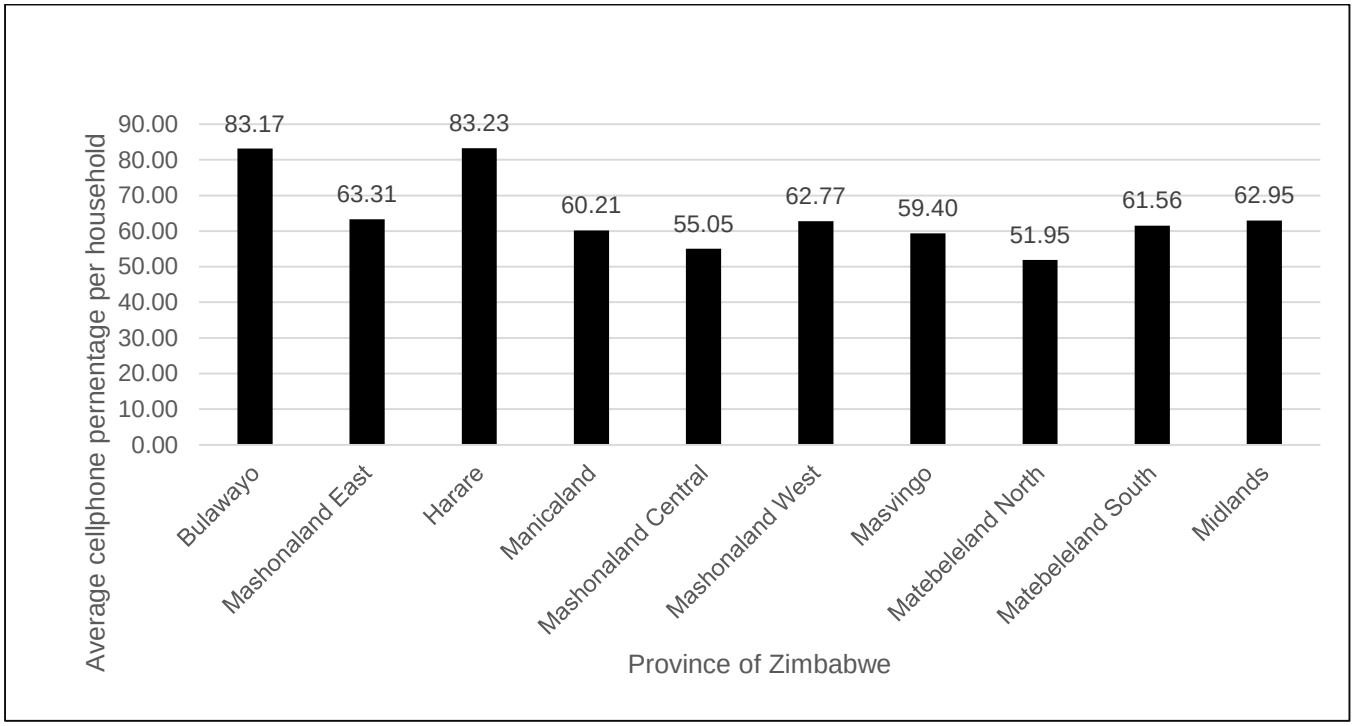

Figure 5.9. Average percentage of cell phone penetration per households in Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

5.3.6 Computer penetration

Computer penetration is regarded as the percentage of household with a computer, in line with data extracted from Global Data Labs 4.2.1. Figure 5.10 shows the average percentage of computer penetration per household in the ten provinces of Zimbabwe. A computer is a necessary tool in business, government, households and any industry. The presence of a computer, all other things held constant, entails better and more efficient processes which may alleviate poverty. The data in Figure 5.11 shows that Harare has the highest average percentage of computer penetration per household at (17.27%), seconded by the second capital city Bulawayo with 16.03. The rest of the provinces have an average percentage of computer penetration per household in an interval between (2.77%) and (6.21%). The general note is that, in all the ten provinces of Zimbabwe, there is low uptake of computers, which is a direct indicator that the ten provinces suffer from poverty induced by a lack of computers.

Detailed explanations will be exposed by econometric data analysis that is empirically manipulated.

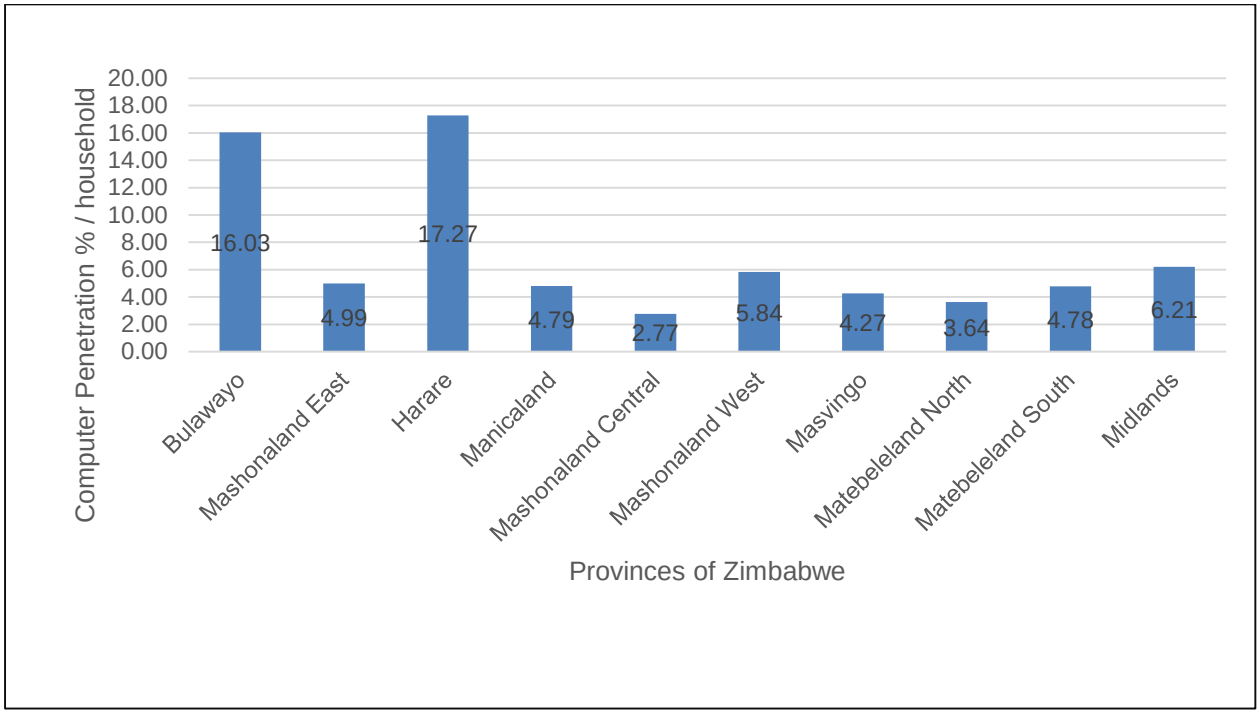

Figure 5.10. Average percentage of computer penetration per households in Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

Computer penetration data trends are being observed in the period 2006 to 2020, and the focus is to explore the relationship between digitalisation and poverty in Zimbabwe.

5.4 RELATIONSHIP BETWEEN DIGITALISATION AND POVERTY IN ZIMBABWE 2006 TO 2020

The relationship plotted of digitalisation and poverty was constructed on the x-y plain whereby digitalisation was independent while poverty was dependent. The resultant regression is shown in Figure 5.12.

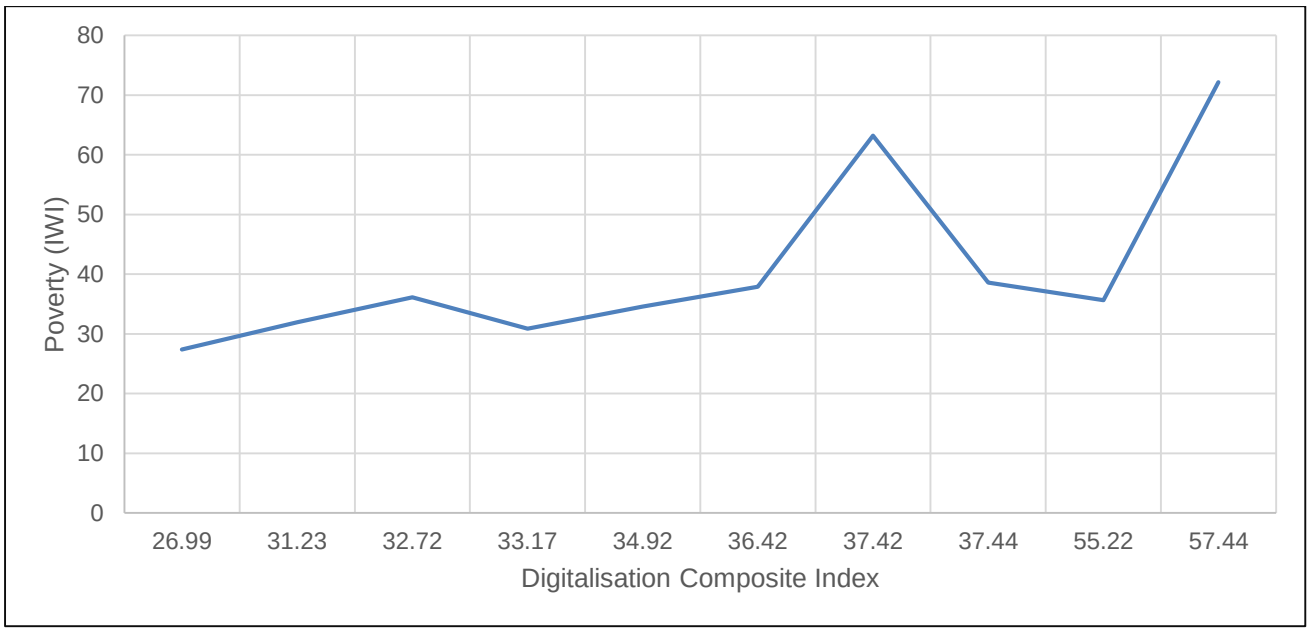

Figure 5.12. Relationship between digitalisation and poverty in Zimbabwe from 2006 to 2020
Source: Researcher's calculations (2023)

Figure 5.12 shows the relationship between poverty and digitalisation in Zimbabwe for the period 2006 to 2020. The preliminary descriptive exposition shows that, generally, there is a moderate positive relationship between poverty and digitalisation in Zimbabwe. From the detail, it implies that an increase in digitalisation has a positive influence on the international wealth index (IWI). However, there are some notable fluctuations which try to explain the possible stubbornness of poverty as it is subjected to digitalisation. Digitalisation levels of 37.43 to 55.22 are associated with a negative relationship with IWI, which brings a different view. The general arbitrary notion is, therefore, that for Zimbabwe to reduce poverty (increase IWI), digitalisation must be increased, which attempts to answer the questions forwarded in Chapter 1. The econometric analysis, to be expedited in the next chapter, will explain the finer details of this relationship.

5.5 EDUCATION

UNDP (2020) itemises quality education as SDG number 4, which points to achieving inclusive and quality education for all, and re-affirms the belief that education is one of the most powerful and proven vehicles for sustainable development. With education, the assumption is that all other things held equal, there is the potential to break the poverty cycle. The data obtained from Global Data Labs 7.0 is illustrated descriptively in Figure 5.13.

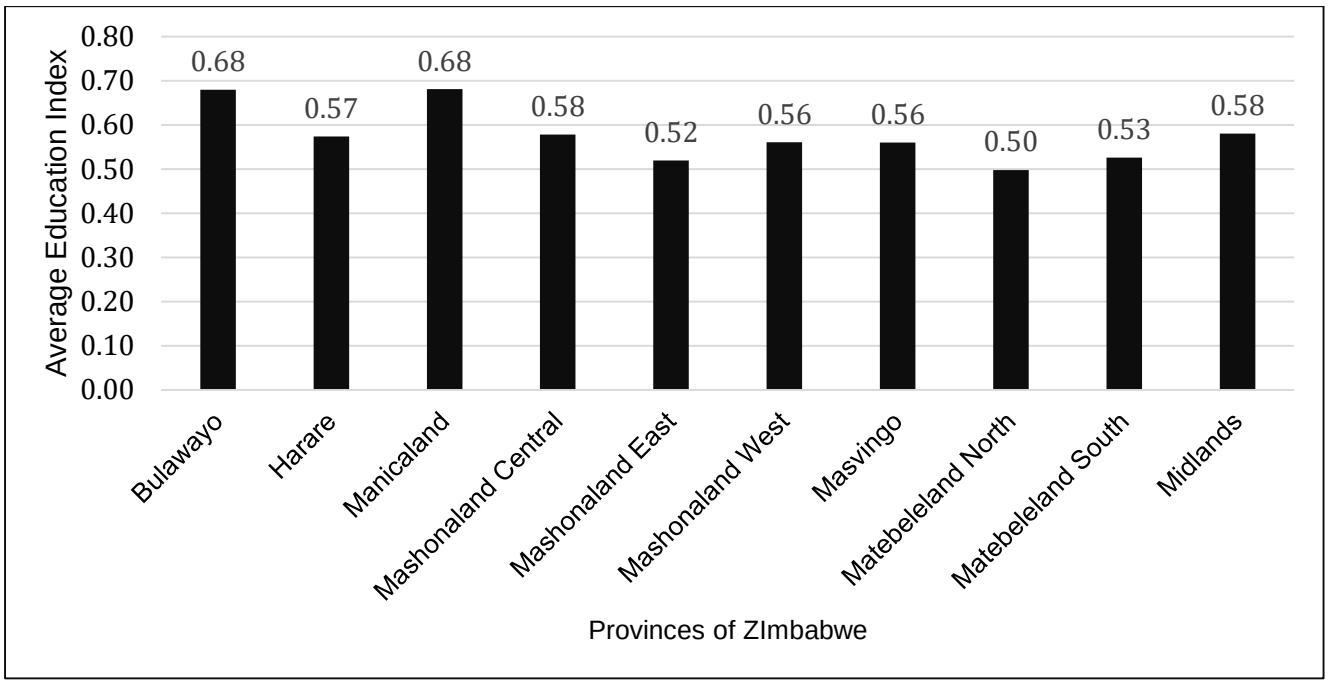

Figure 5.13 Average percentage of education per household of Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

The data on Figure 5.13 shows that Bulawayo and Manicaland have the highest average education index of (68%) each, and the rest of the provinces are in the fifties. Generally, it shows that all provinces of Zimbabwe embed high average levels of education which, from empirical literature, emanates from a strong government policy drive towards education in the country. However, the assumption of the research was that high literacy rates should be related to less reduced poverty, which is somewhat not the case in the Zimbabwean scenario for the period under consideration, which is 2006 to 2020. During this period, Zimbabwe faced high poverty levels as illustrated by Figure 5.13.

5.6 HEALTH

The World Bank (2020) stipulated that poverty is a major cause of ill health and a barrier to accessing healthcare when needed. This points out that health is a factor affecting poverty. UNDP in its SDGs has put health as one of the key issues which needs to be addressed so that the world can ensure healthy lives and promote well-being at all ages, as essential to sustainable development. The data obtained from Global Data Labs 7.0 on Zimbabwe for the period 2006 to 2020 on health has been presented in Figure 5.14. The average access to health is highest in Matebeleland South where the index is 0.6, followed by Matebeleland North and Bulawayo. Lowest rates of average access to health are recorded in Manicaland with 0.5, Mashonaland West with 0.51 and Mashonaland Central with 0.52. The information

shows that there is no uniform access to health in the ten provinces of Zimbabwe, which is a source of concern that policy-makers must address.

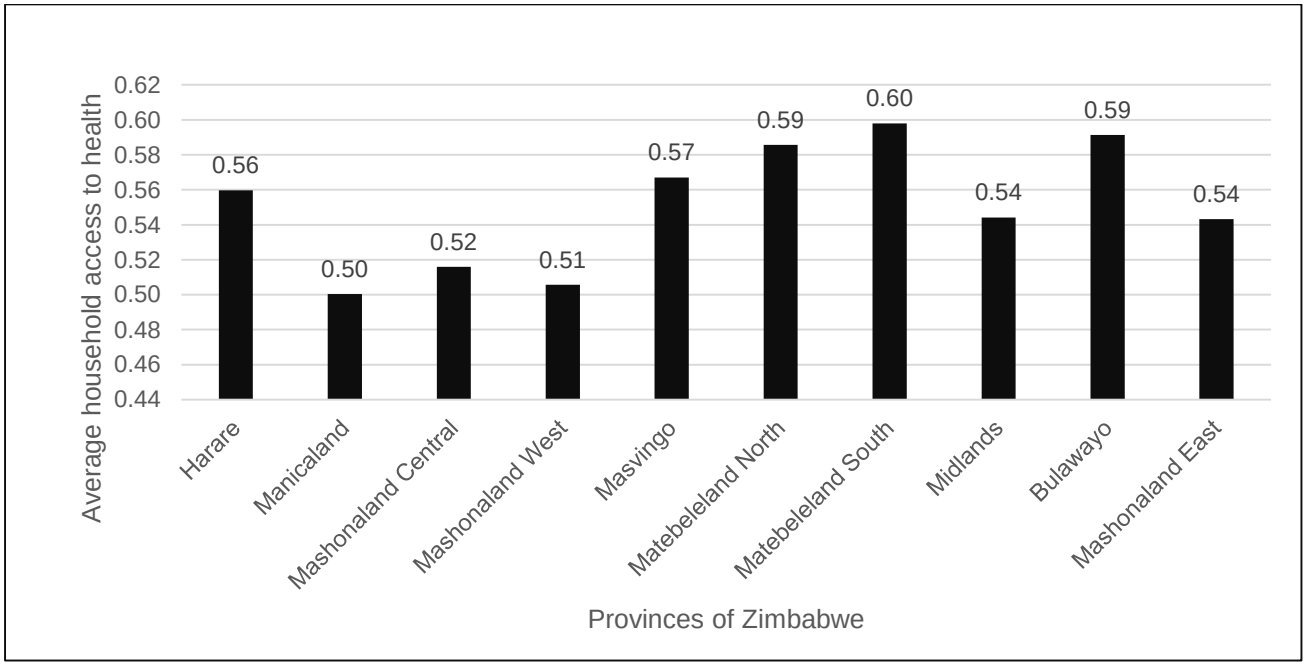

Figure 5.14. Average percentage of health per households of Zimbabwe Provinces from 2006 to 2023

Source: Researcher's calculations (2023)

5.7 HOUSEHOLD SIZE

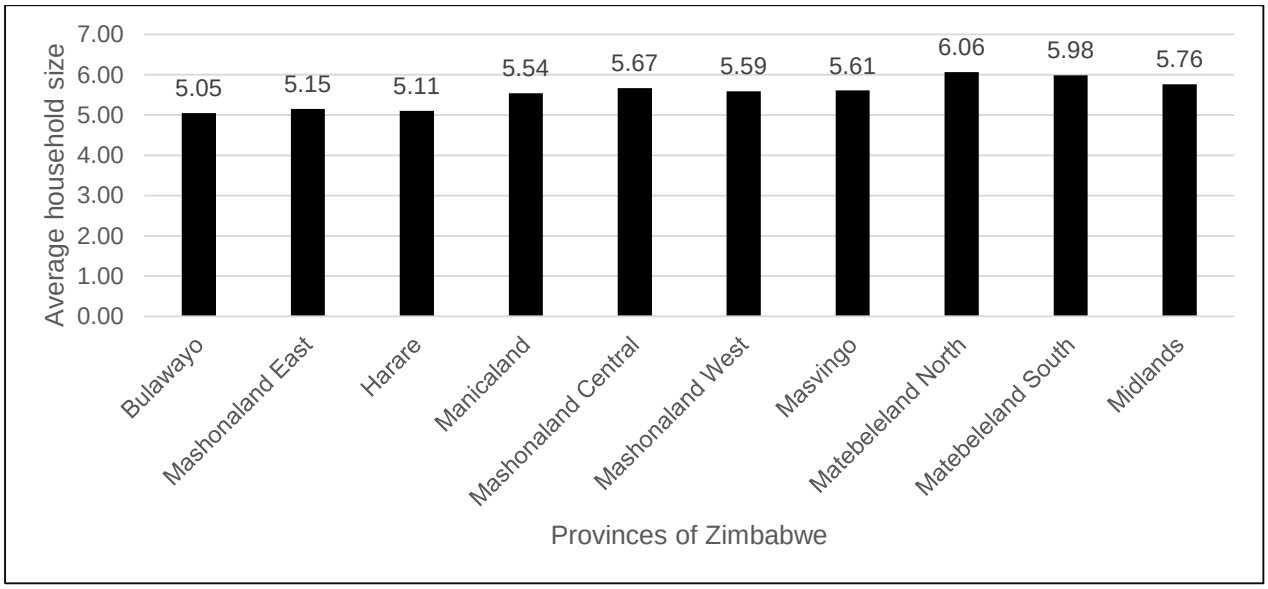

Figure 5.15. Average percentage of household size of Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

Household size is a population aspect which expresses the density of households in the ten provinces of Zimbabwe. The data portrayed by Figure 5.15 shows that most provinces have an average household size of 5 to 6 family members. The information portrayed by Figure 5.15 is for the period covering 2006 to 2020. The assumption is that higher household sizes are related to higher poverty because the family members' needy requirements may be hard to come by, more especially in the African context where subsistence agriculture is the norm.

5.8 URBANISATION

The urban aspect is regarded as the average percentage of people living in the urban areas in a province, in line with data extracted from Global Data Labs 4.2.1. The data shown in Figure 5.16 spans the period 2006 to 2020. In Figure 5.16, the two metropolitan provinces, which are Harare the capital city and the second capital city, have average percentages of people in urban areas at (100%), which reflects reality because these provinces are made up of the city. The rest of the provinces have average percentages of people living in urban centres of below (26%), which reflects very low urbanisation in Zimbabwe.

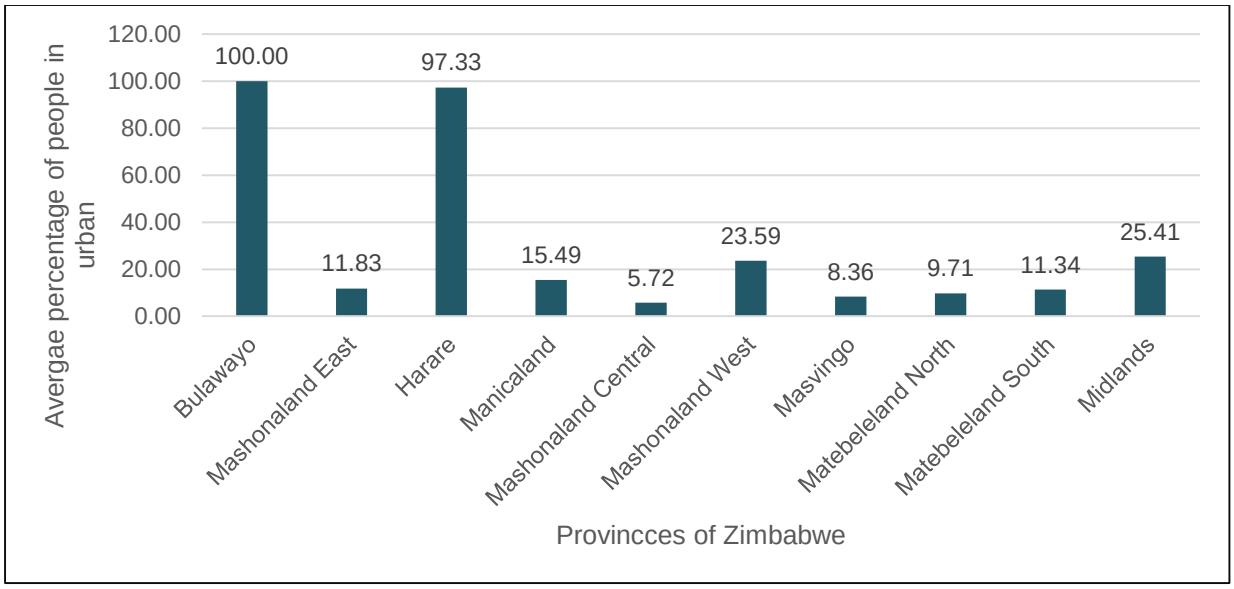

Figure 5.16. Average percentage of people in urban areas of Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

Urbanisation is a result of growth of industries which attracts people from rural to urban centres to work. Therefore, if urbanisation is very low, it is a high indicator that most people in Zimbabwe fall into the poverty domain.

5.9 ACCESS TO ELECTRICITY

Access to electricity is vital for digitalisation. Figure 5.17 shows average access to electricity by a household in their province in the period under study, which is 2006 to 2020. The detail shows that Bulawayo has the highest average access to electricity of (95.58%), followed by Harare which has (82.49%). This shows that the average percentage access to electricity is high in the metropolitan provinces where there are many industries.

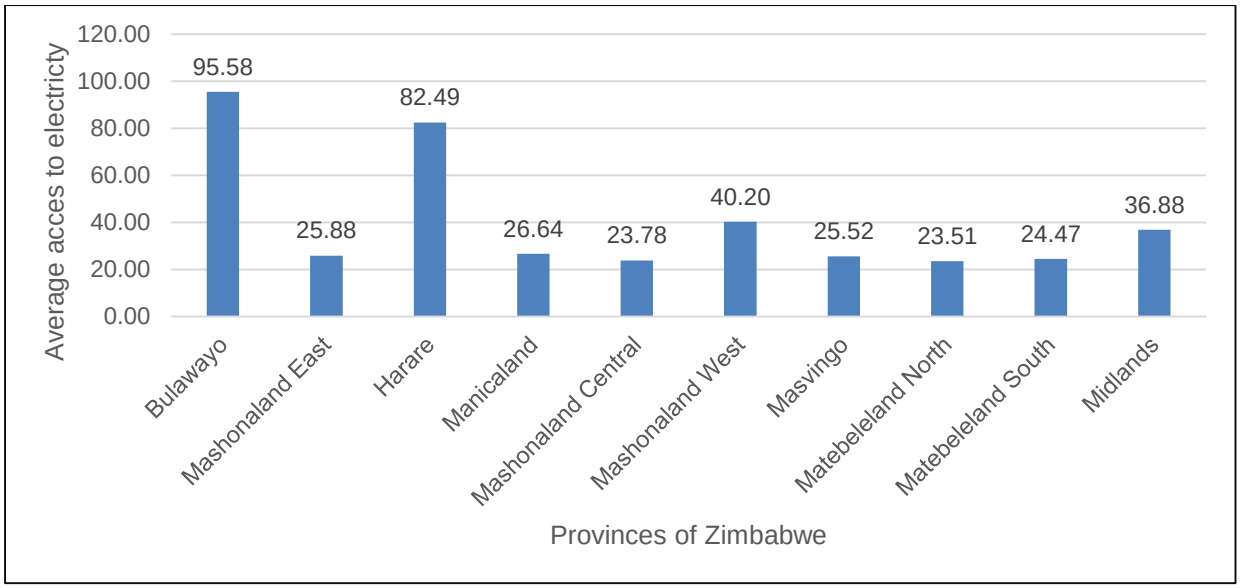

Figure 5.17 Average percentage of access to electricity per households of Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

The rest of the provinces have low average access to electricity below (50%), which are ranging from a lower level of 23.47 in Matebeleland South to at most (40.20%) in Mashonaland East. The general view is that Zimbabwe has low access to electricity, which has a huge impact on poverty, since low access to electricity is associated with few industries, low access to digitalisation gadgets such as computers, cell phone and mechanized equipment which consumes electricity, all pointing to poverty and deprivation. The relationship of digitalisation and poverty is the main thrust of the study.

5.10 ASSET OWNERSHIP

The research shows the asset variable components, which include access to a fridge and access to a motorbike by a household. Asset ownership will be treated as a composite index of ownership of fridge (FRID) and ownership of motorbike (MOTO), which will follow the following equation. The index will be combined using principal component analysis.

Asset = $\alpha_0 + \alpha_1$Fridge + α_2Motor + e……..…(5.2)

Asset ownership is assumed to vary indirectly with poverty levels, meaning that high asset ownership in inversely related to low poverty levels and vice-versa. Below are the stylized facts of access to or ownership of a fridge and a motorbike.

5.10.1 Fridge

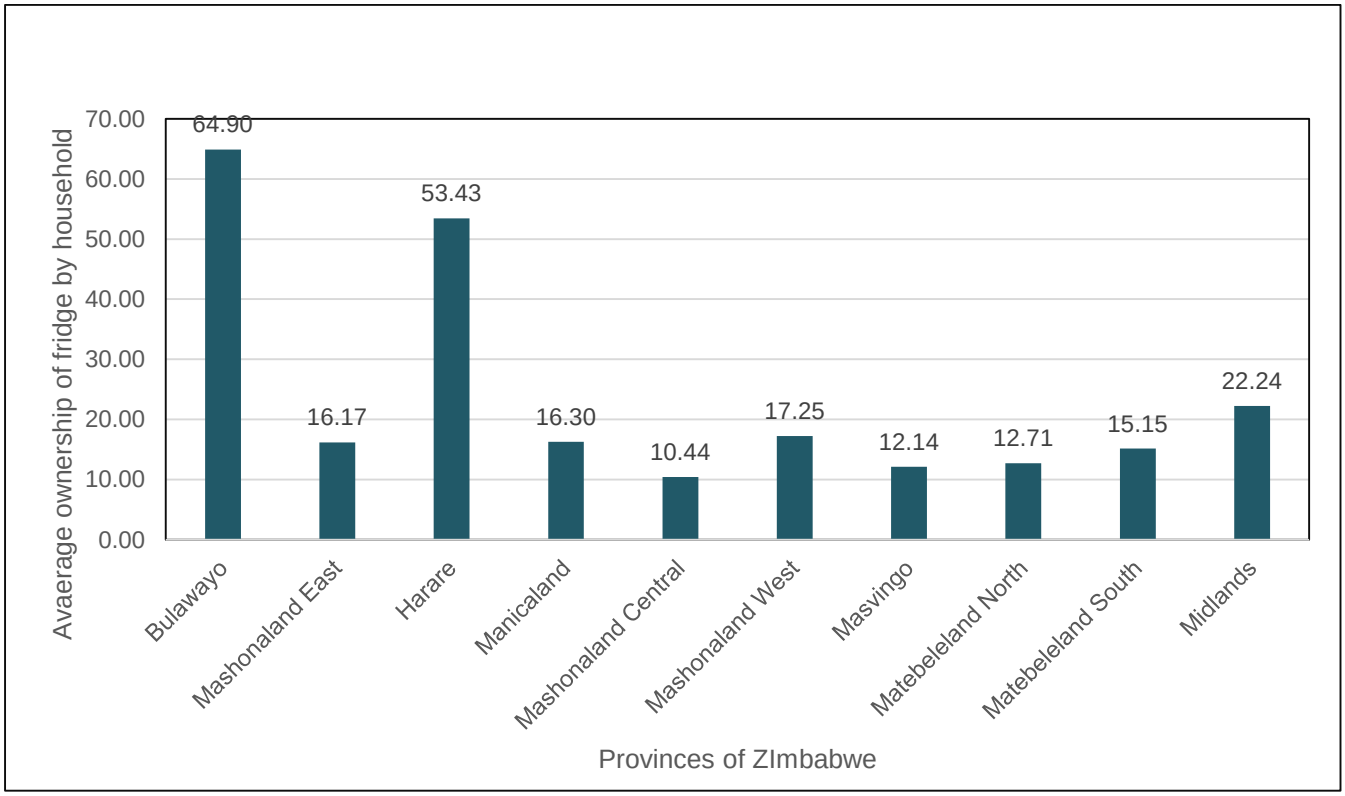

Figure 5.18. Average percentage of ownership of fridge per household in Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

Figure 5.18 shows the average ownership of a fridge by a household in a province. The detail shows that Bulawayo has the highest average ownership of a fridge by a household at (64.90%), followed by Harare which has (53.43%). These two are the metropolitan provinces that are apparently cities, and refrigeration is part of daily life to most urbanites. However, other provinces recorded low levels of ownership of a fridge at around (10.44%) to (22.2%) on the lower side and (22.24%) on the upper side. The general perspective is that Zimbabwe has a low access percentage of ownership of a fridge.

5.10.2 Motorbike

The motor bike aspect from Global Data Labs 4.2.1 was expressed as the average ownership of a motor bike by a household.

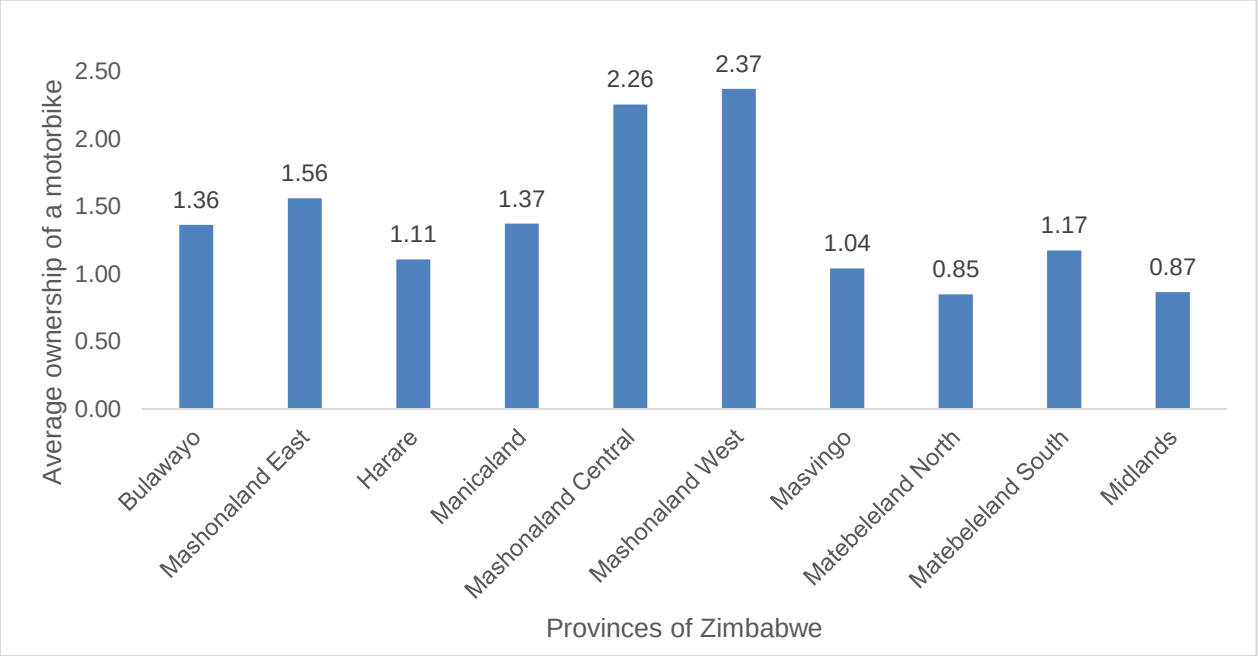

Figure 5.19. Average of households with a motor bike in Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

The average of ownership of a motor bike per household data from Global Data Labs 4.2.1 is illustrated by Figure 5.19 for the period 2006 to 2020. The detail shows that Mashonaland Central and Mashonaland West have the highest average ownership of a motorbike per household at 2.26 and 2.37 respectively. The least average ownership of a motorbike per household is found in Matebeleland North with 0.85, followed by Midlands. Generally, the detail shows that motorbike ownership in the Zimbabwe is not affluent, which indicates a possible inclination that the majority of households cannot afford to buy this transport machine because they are deprived in one dimension or the other.

5.11 HOUSE QUALITY

The Global Data Labs quality of house aspects include access to flush toilets, access to tap water, case of small rooms, types of natural floors, etcetera. In this research, the house quality is to have a proxy that is size of small rooms, which points to the number of cases aggregation percentage of households with none or one sleeping room. The data from Global Data Labs

4.2.1 on quality of house have trends which are somewhat strongly correlated with the various aspects of quality of house herewith mentioned. In this regard, for reduced collinearity in data sets, only one data set has been picked, which is case of small room. The house quality detail showing average cases of small room is illustrated by Figure 5.20 for the period 2006 to 2020.

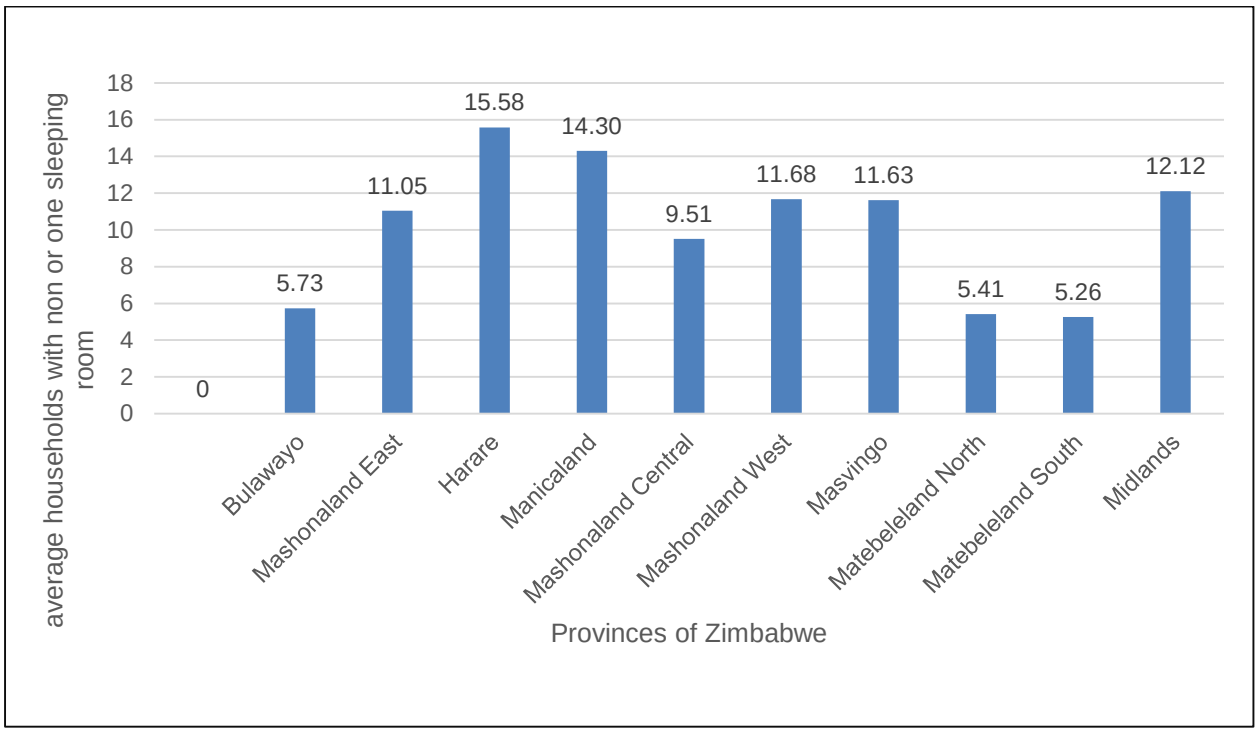

Figure 5.20. Average of percentage case of households with none or one sleeping room, Zimbabwe Provinces from 2006 to 2020

Source: Researcher's calculations (2023)

The detail shown by Figure 5.20 reveal that Harare has the highest average percentage of cases of households with none or one sleeping room of 15.58 %), followed by Manicaland with (14.30%). The lowest average percentage cases of households with none or one sleeping room are found in Matebeleland South with (5.26%) and Matebeleland North with (5.41%). Mashonaland East, Mashonaland West, Masvingo and Midlands have almost equal average percentage cases of households with none or one sleeping room, with figures around (11%) to (12%). The assumption which aligns to reality is that the more cases of households with none or one sleeping rooms, the more the population is subjected to poverty because the households will be deprived of incomes, opportunities or endowments which can allow them to rent or own shelters that can have more than one sleeping rooms.

5.12 CHAPTER CONCLUSION

This chapter looked at stylised facts about digitalisation and poverty in the ten provinces of Zimbabwe. The chapter commenced by presenting stylised facts on poverty and its individual

components, namely the poor, poorer and poorest, and then digitalisation and its components which are access to the internet, access to cell phone and access to computer. A display of the relationship between digitalisation and poverty was described and illustrated. The stylised facts on the rest of the variables, which include asset ownership, comprised two components namely motorbike and fridge, house quality represented by case of house room size, education, health, electricity and household size, were presented and described. It goes without saying that the descriptive analysis will contribute and pave the way for econometric analysis in order to answer the research questions by facts and figures.

The IWI was presented on Figure 5.1 and the results showed that the metropolitan province of Bulawayo has the highest poverty index of 72.14, followed by the metropolitan provinces of Harare with 63.227. Matebeleland North had the least wealth index of 27.36, followed by Mashonaland Central which had the second lowest poverty index of 30.8525. The wealth index was found to be declining from an average index of 63 to 59 over the period 2006 to 2020, meaning that, generally, Zimbabwe provinces embraced a surge in poverty. The IWI was further unpacked into IWI of less than 70, IWI less than 50 and IWI less than 35, which was aligned to the poor, poorer and poorest households. The highest frequency of poor households with an IWI of less than 70 are found in Manicaland, while the lowest in are found in Bulawayo, as depicted by Figure 5.3. There is generally a high average IWI of less than 50 (poorer) with the highest being Mashonaland East, Matebeleland North and Harare. Metropolitan provinces of Bulawayo and Harare have low rates of poorest household at 1.26 and 7.08 respectively, while the poorest province is Matebeleland North at 70 of poorest households, followed by Mashonaland East with approximately 64 %) of households falling into the poorest category.

In this study, digitalisation was obtained as an index of access to cell phone, access to internet, and access to a computer. Harare had high rates of internet, cell phone and computer access by households, while Bulawayo had the highest rates of television access by households. Masvingo, Matebelelalnd North and Matebeleland South had the lowest rates of digitalisation components as compared to Harare and Bulawayo. The relationship between digitalisation and IWI portrayed by the trends shows that there is a positive relationship, as depicted by Figure 5.13.

In terms of other variables included in the study, access to education, urbanization and access to electricity had high rates in Harare and Bulawayo. Matebeleland North had the lowest in access to education, Mashonaland West in terms of urbanisation and Masvingo in terms of access to electricity. Highest rates of access to health are found on Matebeleland South and lowest rates of access to health was Manicaland. Household size had a very small range in terms of difference between provinces, ranging from 5 to 6 members of the household per

province on average. In terms of asset ownership, access to a fridge was high in Bulawayo and Harare, while access to a motorbike was high in Mashonaland West and Mashonaland Central. Harare had the highest rates of cases of households with none or one sleeping room while Matebeleland South had the lowest of such cases. The next chapter will explicate the empirical results using the econometric panel data analysis to provides detail which will answer the research questions.

CHAPTER 6: ANALYSIS OF EMPIRICAL RESULTS

6.1 INTRODUCTION

This chapter presents the empirical results, which address the following empirical objectives:

- To establish the relationship between digitalisation and poverty dimensions in Zimbabwe;
- To investigate the causal relationship that exists between digitalisation and poverty dimensions in Zimbabwe; and
- To evaluate the effect of digitalisation and poverty in Zimbabwe.

The chapter commences by presenting descriptive statistics that are useful as a starting point in analysing the data. A correlation analysis is carried out, which answers the first objective of the study that sought to determine the linear relationship between the variables (digitalisation, poverty, education, health, household size, house quality, asset ownership, electricity and urbanisation). This lays the initial exposition for the presence of a relationship between digitalisation and poverty. The chapter further gauges the Dumitrescu-Hurlin causality relationship between digitalisation and poverty, and a tabular approach was outlaid, as well as the interpretation thereof in pursuit of answering the third objective in this foregoing research. The Ordinary least squares model (OLS), fixed effects model (FEM), random effects model (REM) and generalised method of moments models (GMM) are utilised in the quest to answer the fourth objective, which sought to inquire into the impact of digitalisation on poverty in Zimbabwean provinces using a panel data approach. Pre-estimation tests such as multicollinearity tests, heteroscedasticity tests and stationarity tests, as well as post-estimation test tests such as Haussmann test, Sargan tests, Wald tests and Arellano and Bond serial autocorrelation tests, are utilised to enhance the validity, reliability and consistency of the estimations.

6.2 DESCRIPTIVE STATISTICS

Descriptive statistics details the number of observations, mean, maximum, minimum and standard deviation, and also presents the skewness, kurtosis, chi square, probability and sum of observations. Stata statistical software was utilized to produce the summary statistics. Pearson (1983) coined the standard deviation as a vital measure of dispersion and skewness as the beta coefficient of the cantered moments, which is popularly utilized by most, if not all, statisticians and econometricians. Kurtosis, which is a measure of whether the data are heavy-tailed or light-tailed relative to a normal distribution, has conditions such that if a value is zero or close to zero, it is symmetrical or normal but platykurtic; while values above one may be

mesokurtic if on the lower side but leptokurtic if on the upper side. Table 6.1 presents descriptive statistics in the form of summary statistics**,** also annexed in appendices 1 and 2.

Table 6.1 Summary statistics

Statistic	IWI	DIG	EDU	HEA	HHSE	URB	ASSET	ELE	HSEQ
Obs	150.0000	150.0000	150.0000	150.0000	150.0000	150.0000	150.0000	150.0000	150.0000
Mean	41.0978	48.8549	0.5758	0.5511	5.5514	30.8782	18.0097	40.4943	10.2277
Max	84.7450	102.5800	0.7390	0.6990	6.8400	100.0000	52.5711	98.1900	17.6775
Min	19.3900	2.2400	0.4530	0.3420	4.6800	5.4000	3.9386	10.4700	4.7500
Std Dev	14.7166	25.1649	0.0661	0.1012	0.4206	34.5697	13.7230	27.0471	3.6313
Skewness	0.0000	0.7028	0.0010	0.0740	0.4090	0.0000	0.0000	0.0000	0.7570
Kurtosis	0.3714	0.0060	0.9800	0.0000	0.9130	0.5960	0.4200	0.3300	0.0000
Chi Sq	20.3100	15.4600	9.4900	46.2100	0.7000	25.2900	22.0900	17.2400	29.0800
prob > chi2	0.0000	0.0004	0.0090	0.0000	0.7040	0.0000	0.0000	0.0000	0.0000
Sum	6164.0700	8364.1720	86.3690	82.6660	832.7030	4631.7300	2701.4500	6074.1450	1534.1600

Source: Author's Calculation (2023)

Digitalisation has 150 observations, which have a mean of 48.8549, the maximum observation being at 102.58 while the minimum observation being 2.24, with a standard deviation of 25.1649, which shows high variability of data. Digitalisation is positively moderately skewed at 0.7028, while its kurtosis of 0.006 means that it is platykurtic. A platykurtic distribution will have thinner tails than a normal distribution, resulting in fewer extreme positive or negative observations of the variable digitalisation. The digital variable has a chi square of 15.46 and a probability of 0.0004, from a sum of 8364.172.

The *Education index* has 150 observations, which have a mean of 0.575793, where the maximum observation is 0.739 and the minimum is 0.453 with a standard deviation of 0.066134, which shows low variability. The low variability means that the observations of the data is consistent and it is easy to predict the population parameters using the sample data of education. The Education index is positive weakly skewed at 0.001 with a kurtosis of 0.980 which means that it is mesokurtic, implying that the existence of outlier observations is close to zero, which aligns to the consistency of the data in this case. The Education index has a chi square of 9.49 and a probability of 0.009. The sum of observations is 86.369.

The *health index* has 150 observations, which have a mean of 0.551107, with a maximum observation of 0.669, a minimum observation of 0.342, and a standard deviation of 0.101196. This shows low variability, which means there is consistency in the data. The Health index is positively but weakly skewed at 0.074 and its kurtosis is 0.000, which shows that it is platykurtic while having a chi squared of 46.21 and a probability of 0.000. This means that the data on

health have thinner tails, indicating that very few data are on the extreme negative and extreme positive. The sum of observations is 82.666.

Household size has 150 observations, which have a mean of 5.55135, where the maximum observation is 6.84 and the minimum observation is 4.68, having a standard deviation of 0.4206. This shows low variability and is hence consistent. Household size has a strong and positively skewed data set, which is mesokurtic because it shows a skewness of 0.409 and kurtosis of 0.913. The chi square is 0.7 with a probability of 0.704, meaning that the existence of outlier observations is close to zero. The sum of observations is 832.703.

Urbanization has 150 observations with a mean of 5.55135, having a maximum observation of 100, a minimum observation of 5.4, and standard deviation of 34.56966, which shows high variability. Urbanization data has zero skewness, meaning that it is perfectly symmetrical, while the kurtosis is 0.596. This supports the symmetrical and mesokurtic aspect of the data. Urbanization has a chi square of 25.29 and a probability of 0.000. The sum of observations is 4631.730.

Asset ownership has 150 observations with a mean of 18.00966, where the maximum observation is 52.57112 and minimum observation is 3.938547, with a standard deviation of 13.72304 showing high variability in the data set, which means that this data is less consistent. Asset ownership data is symmetrical, shown by a skewness of 0.00 and a kurtosis of 0.420, which means it is mesokurtic. It has a chi square of 22.09 and a probability of 0.00. Despite being less consistent, it has fewer data on the outliers. The sum of observations is 2701.449.

House quality has 150 observations, with a mean of 10.2277. The maximum observation is 17.6775 and the minimum is 4.75, with a standard deviation of 3.631306, which shows lower variability and is hence consistent and more predictable. House quality has a skewness of 0.757, which shows weak but positive skewness, but a kurtosis of 0.00 which means it is platykurtic. The chi square is 29.08, while the probability is 0.000. Hence the data has fewer extreme positive or negative observations of the variable ‘digitalisation’, which aligns to the consistency. The sum total of observations is 1534.256.

The summary descriptive statistics shown by Figure 5.22 indicate that there are 150 observations being studied in the ten provinces of Zimbabwe in respect of poverty, which is being proxied by IWI; digitalization which is a composite index of internet, computer, cell-phone and television; as well as other independent variables, which include education, health, household size, asset ownership, electricity as well as house quality.

IWI has a mean index of 41.0978 across all provinces, whereby the minimum wealth index is 19.39 and the maximum 84.7450. The variability of the wealth elements is 14.7166, which means it is high and hence inconsistent; while its skewness is 0.00, meaning that data is extremely symmetrical around the mean. IWI has a kurtosis of 0.371, indicating that the data is mesokurtic A mesokurtic distribution has a similar extreme value character as a normal distribution, which means that the probability of extreme events is close to zero or zero. IWI has a chi square of 20.31 and a probability of 0.000, and the sum of the IWI data is 6164.070.

The variable *electricity* has150 observations and a mean of 40.4943, which have a maximum observation of 98.19, a minimum observation of 10.47 and a standard deviation of 27.04709, showing high variability. Hence it is very inconsistent and difficult to predict future data trends. The data is close to symmetrical one as shown by a skewness of 0.00 and a kurtosis of 0.330. Electricity has a chi squared of 17.24 and a probability of 0.000, which means that the probability of outlier extreme events is close to zero. The sum of observations is 6074.145.

6.3 CORRELATION ANALYSIS

The first objective was determine whether there is a relationship between digitalization and the poverty dimension in Zimbabwe's ten provinces. The data to be used is for Zimbabwe for the period between 2006 and 2020. To establish this relationship, a correlation analysis was utilized. The results of the correlation obtained using the Stata Statistical Software is illustrated in Table 6.2 and annexed in Appendix 3.

Table 6.2 Correlation Matrix

	DIG	IWI	EDU	ELE	ASSET	HEA	HHSE	HSEQ	URB
DIG	1								
IWI	0.6211	1							
EDU	0.7578	0.9016	1						
ELE	0.5315	0.9383	0.8472	1					
ASSET	0.653	0.9559	0.9093	0.9527	1				
HEA	0.8582	0.3221	0.4319	0.2418	0.3763	1			
HHSE	-0.7164	-0.7003	-0.8200	-0.6597	-0.7161	-0.4233	1		
HSEQ	0.2417	0.0901	0.3820	0.0918	0.0760	-0.0670	-0.3834	1	
URB	0.4114	0.9395	0.8214	0.9223	0.9176	0.099	-0.5635	0.1043	1

Source: Author's calculations (2023)

Galton (1888) introduced the correlation analysis developed by Pearson (1840) in the quest to find whether a linear relationship existed between variables, and then determining the magnitude and action of that relationship. This statistical tool addresses the first empirical objective of the study, whereby the quest is to find out if digitalisation has a relationship with

poverty. The data was manipulated by Stata, as shown in Appendix 3. The data presented by Table 6.2 shows that the digitalisation index, which is a composite index of internet, cell-phone, computer and television and poverty index as proxied by the international wealth index (IWI) have a correlation coefficient of 0.6211, indicating that there is a positive moderate association between the two. This implies that an increase in digitalisation is strongly associated with an increase in the international wealth index, whereby an increase in wealth definitely leads to a reduction in the deprivation of the households in various facets, also known as poverty. The descriptive results align with Yilmaz et al. (2018), Akinboade et al. (2020) and Mateko (2022), although these authors used ICT instead of digitalisation, and their components of ICT where somewhat different from the current study, as discussed earlier in the literature review. However, the correlation analysis does not determine causality in the relationship, which shows how each variable affects each other. This study tried to further empirically investigate the causality using the Dumitrescu-Hurlin causality test.

In cohorts with digitalisation, in the explanatory variables space are education, health, household quality, house quality, asset ownership, electricity and urbanization, which the study also sought to show a relationship with poverty (IWI), as well as amongst themselves. Firstly, digitalisation and education have been found to have a strong positive association of 0.7578, as much as digitalisation and access to electricity, which have a moderate positive association of 0.5315 as well. The data shows that digitalisation and asset ownership have a strong positive association of 0.653, as much as digitalisation and health also have a strong positive association of 0.8582. However, digitalisation and household size have a strong negative association of 0.7164, and digitalisation and house quality have a weak positive association of 0.2417. Digitalisation and urbanisation have a moderate positive association of 0.4114.

The data presented by Table 6.2 shows a strong positive association between IWI and education, IWI and electricity, IWI and asset ownership of 0.9016, 0.9383 and 0.9559 respectively. However, IWI and health have a weak positive association of 0.3221, and IWI has a rather strong negative association with household size of 0.7003. IWI and house quality have a positive and very weak association of 0.0901, and IWI has a positive strong association with urbanization of 0.9395.

Education and electricity, and education and asset ownership, have a positive strong association of 0.8472, and 0.9093 respectively. However, education and health have a weak positive relationship of 0.4319, while education and household size have a negative strong association between the two, indicated by 0.8207. Education and house quality have a weak

positive association of 0.3821, but education and urbanization show a strong positive relationship of 0.8214.

Electricity and asset ownership have a strong positive association of 0.9527, while electricity and health have a weak positive association of 0.2418. Electricity and household size have a moderate negative association of 0.6597, but electricity and house quality have a very weak positive association of 0.0918. Electricity and urbanization also have a strong positive association of 0.9223.

Asset ownership and health have a weak positive relationship of 0.3763, but asset ownership and household size show a negative strong negative relationship of 0.7161. Asset ownership and house quality have a very weak positive relationship of 0.076, while asset and urbanization have a strong positive relationship of 0.9176.

Health and household size have a weak negative association 0.4233, and health and house quality have a weak negative association of 0.067. Health and urbanization have a weak positive relationship of 0.099. Household size and house quality have a weak negative association of 0.3834, as much as household size and urbanization have a moderate negative relationship of 0.5600. Lastly, the data in Figure 5.23 shows that house quality and urbanization have a weak positive association of 0.1043, meaning that a change in house quality is weakly associated with a change in urbanization.

6.4 PRE-ESTIMATION TESTS

6.4.1 Multicollinearity

The variable inflation factor (VIF) was computed so that, in the regression analysis, the level of multi-collinearity can be ascertained. In multivariate regression model, multi-collinearity exists when there is a correlation between many independent variables. An overall VIF of 16.62 was achieved, which showed that there was high multi-collinearity between the variables.

The researcher changed the data set into logarithm format for the nine variables. Logarithmic transformations can help stabilize the variance of the data. In cases where the variance of the data increases with the mean (heteroscedasticity), taking the logarithm can reduce this effect. Upon checking for the variance inflation factor of the logged data, the result was that Education and Asset had a high IVF of above 10, hence they were removed. Upon removal, the remaining six variables had a lower VIF of close to 5, and the overall IVF dropped to 3.92, which showed a lower multi-collinearity problem in the dataset. See appendices 5 and 6 for IVF details.

6.4.2 Heteroscedasticity

The Breusch-Pagan Test was developed in 1980, which is used to ascertain heteroscedasticity (Dunga, 2014). The Breusch-Pagan Test assumes that heteroscedasticity may be a linear function of all the independent variables in a model (Halunga, Orme & Yamagata, 2017). The Breusch-Pagan test will be used in this study for the purpose of determining the choice between random effects and fixed effects. Heteroscedasticity assists in checking if data is not spurious, which is a statistical problem. The hypothesis was as follows:

Null Hypothesis H_0: There is homoscedasticity (constant variance of errors).

Alternative Hypothesis H_1: There is heteroscedasticity (varying variance of errors).

A p-value of 0.0377 was obtained from the six independent variables and the dependent variable, which showed that there is evidence to reject the null hypothesis at the 0.05 significance level, as shown in Appendix 7. This suggests that the variance of the errors is likely not constant across all observations, indicating the presence of heteroscedasticity.

6.4.3 Stationarity

According to Paparoditis (2010), a stationary situation in econometrics is a stochastic process in which the unconditional joint probability distribution does not change as time passes. As a result, parameters such as mean and variance do not vary over time. The variables in this foregoing research were tested for stationarity using a robust method of five methods. However, all have a similar null hypothesis that panels contain unit roots, and an alternative being that panels are stationary. The following results were obtained. Table 6.3 illustrates the results from stationarity tests carried out.

Table 6.3 Stationarity tests

Variable	Levin-Lin-Chu Test	Hadri LM Test		Breitung Test	Harris-Tzavalis Test
Log_IWI	-2.8576***	23.0725***	3.5385***	3.7257	0.9048
	(0.0021)	(0.0000)	(0.0002)	(0.9999)	(0.9353)
Log_DIG	-3.2015***	21.2296***	110.4909***	2.9487	0.7496
	(0.0007)	(0.0000)	(0.0000)	(0.9984)	(0.1508)
Log_ELE	3.7502	17.0553***	-2.7929	0.9405	1.1133
	(0.9999)	(0.0000)	(0.9974)	(0.1735)	(1.0000)
Log_HEA	-11.6178***	24.1192***	2.0029	0.2183	0.9044
	(0.0000)	(0.0000)	(0.0226)	(0.0145)	(0.9343)
Log_HHSE	2.1208	20.4911***	0.7233	2.1853	0.9528
	(0.9830)	(0.0000)	(0.2347)	(0.9856)	(0.9898)
Log_HSEQ	-2.0412	22.0806***	3.3220***	1.0709	0.9169
	(0.0206)	(0.0000)	(0.0004)	(0.8579)	(0.9568)
Log_URB	-0.7738	19.1964***	-2.7060	-1.4193	0.0189
	(0.2195)	(0.0000)	(0.9966)	(0.0779)	(0.9917)

Note: (*), (**) and (***) indicate 1%, 5% and 10% significance level, respectively

Source: Researcher's calculations (2023)

The hypothesis for stationarity is as follows:

Null hypothesis H_0: non-stationary

Alternative hypothesis H_1: stationary

A robust operation was done when checking for the stationarity of variables. A p-value of p less than 0.05, such as a p = 0.000, is typically interpreted as strong evidence against the presence of a unit root. In other words, there is enough statistical evidence to conclude that the variable is stationary.

Using the Levin-Lin-Chu test, the results show that the international wealth index, digitalisation and health are all stationary at a (1%) significance level. The other variables such as Electricity, Household Size, House Quality and Urbanisation are non-stationarity at lag 1 at (1%), (5%) and (10%). Using the Hadri LM test for stationary for all variables (international wealth index, digitalisation, electricity, health, household size and urbanisation) the results show that all variables stationary at the (1%) level of significance.

The results show that when using the Fisher's Augmented Dickey-Fuller stationarity test, international wealth index, digitalisation and house quality are stationary at lag 1, and at a (1 %) level of significance. The other variables, which include electricity, health and urbanisation, are non-stationary at the (1%), (5%) and (10%) significant levels. Using the Breitung stationarity test, all variables were non-stationary at lag 1, at (1%), (5%), and (10%). The Harris-Tzavalis stationarity test also showed that all variables were non-stationary at lag 1, at (1%), (5%) and (10%). The key result is that all the nine variables are found to be stationary in at least one of the methods.

6.5 PANEL CAUSALITY ANALYSIS

The third objective was to find the causal relationship between digitalization and the poverty dimension in Zimbabwe. To establish this causal relationship, a unique granger causality test called the Dumitrescu-Hurlin causality test was utilized to gauge the causality relationship. The Dumitrescu-Hurlin causality test was preferred because the data is in panel format, whereas Granger causality is mostly usefully tested on time-series data. The researcher first declared data to be in panel form and checked if it is balanced before proceeding to manipulate the causality of the variables. The results show that there are seven variables, which includes the international wealth index, digitalisation, electricity, health, household size, house quality and urbanisation; and 150 observations, which agrees with the fact that there are 10 provinces in Zimbabwe; and the time span is 2006 to 2020, making it 15 years, which agrees with the 150 observations.

Traditionally, causality had been tested using the Granger causality test. Granger causality gives information about forecasting abilities but not about the true causal relationship between two variables. The Dumitrescu and Hurlin (2012) test can alternatively be used, and it achieves best size when regression lags *p* are smallest (regardless of the underlying true AR structure), and the best power when p matches the true AR structure, with a severe penalty for underspecifying p. Hence it is a better predictor of causality than the Granger causality test. For the Dumitrescu-Hurlin causality relationship between dependent variable and independent variables, the Table 6.4 from Stata output presents the results. International wealth index and digitalisation's causality detail is annexed in Appendix 4.

Table 6.4: Dumitrescu-Hurlin Causality Tests

Null Hypothesis	W bar	Z bar	P value
Log_IWI does not homogenously granger cause Log_DIG	2.5415	3.4470	0.0006***
Log_DIG does not homogenously granger cause Log_IWI	44.0736	6.8728	0.0000***
Log_IWI does not homogenously granger cause Log_ELE	5.1460	9.2708	0.0000***

Log_ELE does not homogenously granger cause Log_IWI	10.7415	21.7827	0.0000***
Log_IWI does not homogenously granger cause Log_HEA	3.9602	6.6193	0.0000***
Log_HEA does not homogenously granger cause Log_IWI	8.2646	16.2442	0.0000***
Log_IWI does not homogenously granger cause Log_HHSE	4.1666	7.0808	0.0000***
Log_HHSE does not homogenously granger cause Log_IWI	1.9201	2.0575	0.0396**
Log_IWI does not homogenously granger cause Log_HSEQ	1.8399	1.8781	0.0604
Log_HSEQ does not homogenously granger cause Log_IWI	4.3444	7.4783	0.0000***
Log_DIG does not homogenously granger cause Log_ELE	0.3990	-1.3438	0.1790
Log_ELE does not homogenously granger cause Log_DIG	5.5487	10.1712	0.0000***
Log_DIG does not homogenously granger cause Log_HEA	9.8279	19.7398	0.0000***
Log_HEA does not homogenously granger cause Log_DIG	12.9033	26.6166	0.0000***
Log_DIG does not homogenously granger cause Log_HHSE	0.6377	-0.8102	0.4178
Log_HHSE does not homogenously granger cause Log_DIG	1.1856	0.4149	0.6782
Log_DIG does not homogenously granger cause Log_HSEQ	1.3591	0.8030	0.4220
Log_HSEQ does not homogenously granger cause Log_DIG	2.1149	2.4931	0.0127
Log_ELE does not homogenously granger cause Log_HEA	6.6163	12.5584	0.0000***
Log_HEA does not homogenously granger cause log-ELE	2.1421	2.5539	0.0107
Log_ELE does not homogenously granger cause Log_HHSE	9.8056	19.6898	0.0000***
Log_HHSE does not homogenously granger cause Log_ELE	1.5041	1.1273	0.2596
Log_ELE does not homogenously granger cause Log_HSEQ	6.4085	12.0939	0.0000***
Log_HSEQ does not homogenously granger cause Log_ELE	2.2742	2.8492	0.0044***
Log_HEA does not homogenously granger cause Log_HHSE	5.4298	9.9053	0.0000***
Log_HHSE does not homogenously granger cause Log_HEA	1.7859	1.7574	0.0789
Log_HEA does not homogenously granger cause Log_HSEQ	9.0680	18.0407	0.0000***
Log_HSEQ does not homogenously granger cause Log-HEA	5.7785	10.6850	0.0000***

Log_HHSE	does	not	homogenously	granger	cause			
Log_HSEQ						3.5692	5.7449	0.0000***
Log_HSEQ	does	not	homogenously	granger	cause			
Log_HHSE						2.1679	2.6116	0.0090***

Note: (*), (**) and (***) indicate 1%, 5% and 10% significance level, respectively

Source: Researcher's calculations (2023)

On the first equations regarding international wealth index and digitalisation, the p-value is less than (5%) for the equation between international wealth index and digitalisation and the null hypothesis is rejected, which points out that IWI does homogenously cause digitalisation. For the other alternate digitalisation and international wealth index equation, the p-value is also less than (5%), which shows that digitalisation does homogenously cause international wealth index, and hence rejects the null hypothesis. Therefore, there is bi-directional causality between international wealth index and digitalisation. The results of the Dumitrescu-Hurlin test between international wealth index and digitalisation align with apriori expectations that digitalisation does cause IWI, and vice versa.

In the second equation between international wealth index and electricity, the p-value is less than (5%) for both, hence it can be concluded that the null hypothesis is rejected. This shows that international wealth index does homogenously cause electricity, and electricity does homogenously cause international wealth index, implying that there is a bi-directional causality between the two variables. In the third equation between international wealth index and health, the p-value is less than (5%) for both, hence it can be concluded that the null hypothesis is rejected. This points out that international wealth index does homogenously cause health, and health does homogenously cause international wealth index. In other words, there is a bi-directional causality between the two variables.

The fourth equation is between international wealth index and household size, where the p-value is less than (5%) for both, hence it can be concluded that the null hypothesis is rejected. This points out that international wealth index does homogenously cause household size and household size does homogenously cause international wealth index. In other words, there is a bi-directional causality between the two variables. The fifth equation is between international wealth index and house quality, and the p-value is more than (5%) for international wealth index and house quality; but for house quality and international wealth index, it is less than (5%). This points out that international wealth index does not homogenously cause house quality but house quality does homogenously cause international wealth index. In other words, there is a uni-directional causality between the two variables. In the equation between

international wealth index and urbanisation, the p-value is unidentified for both, hence it can be concluded that the causal relationship is unidentifiable for both.

For the equation which has digitalisation and electricity, the p-value is more than (5%) for digitalisation and electricity at 0.1790, which means that one can accept the null hypothesis and conclude that digitalisation does not homogeneously cause electricity. However, for electricity and digitalisation, the p-value is less than (5%), which means that it can be concluded that the null hypothesis is rejected in this case. This points out that electricity does homogenously cause digitalisation. The results show that there is a uni-directional causality between the two variables.

In the equation between digitalisation and health, the p-value is less than (5%) for both digitalisation and health, and health and digitalisation equations. Hence the null hypothesis is rejected, and a conclusion that digitalisation homogeneously causes health as much as health homogeneously causes digitalisation, as shown. It shows that there is a bi-directional causality between the two variables.

In the equation between digitalisation and household size, the p-value is (0.15%), which is more than (5%) for both, hence it can be concluded that the null hypothesis is accepted for both. This points out that digitalisation does not homogenously cause household size as much as household size does not homogenously cause digitalisation. In other words, there is no causality between the two variables.

In the equation between digitalisation and house quality, the p-value is more than (5%) for digitalisation and house quality, but the p-value for house quality and digitalisation is less than (5%). Hence it can be concluded that the null hypothesis is accepted for digitalisation and house quality, but rejected for house quality and digitalisation. This points out that digitalisation does not homogenously cause house quality, but house quality does homogenously cause digitalisation. In other words, there is a uni-directional causality between the two variables. For the equation between digitalisation and urbanisation, the p-value is unidentified, hence it can be concluded that the two variables failed to indicate their causal relationship in the data provided.

In the equation with electricity and health, the p-value is less than (5%) for both, hence it can be concluded that the null hypothesis is rejected. This points out that electricity does homogenously cause health, and health does homogenously cause electricity. In other words, there is a bi-directional causality between the two variables.

For the equation electricity and household size, the p-value is less than (5%), but for household size and electricity, the p-value is more than (5%). Hence it can be concluded that the null hypothesis is rejected for electricity and household size, but accepted for household size and electricity. This points out that electricity does homogenously cause household size, but household size does not homogenously cause electricity. In other words, there is a uni-directional causality between the two variables.

In the equation with electricity and house quality, the p-value is less than (5%) for both, hence it can be concluded that the null hypothesis is rejected. This points out that electricity does homogenously cause house quality and house quality does homogenously cause electricity. In other words, there is a bi-directional causality between the two variables. The p-value for electricity and urbanisation is unidentified, hence the causality is also unidentified.

In the equation with health and household size, the p-value is less than (5%) for health and household size; but for household size and health, the p-value is more than (5%). It can be concluded that the null hypothesis is rejected for health and household size, but accepted for household size and health. This points out that health does homogenously cause household size, but household size does not homogenously cause health. In other words, there is a uni-directional causality between the two variables. In the equations with health and house quality, the p-value is less than (5%) for both, hence it can be concluded that the null hypothesis is rejected. This points out that health does homogenously cause house quality and house quality does homogenously cause health. In other words, there is a bi-directional causality between the two variables. In the equation with health and urbanisation, the p-value is unidentified and hence the causal relationship is unidentified.

In the equation with household size and health, the p-value is less than (5%) for both, hence it can be concluded that the null hypothesis is rejected. This points out that household size does homogenously cause house quality and house quality does homogenously cause household size. In other words, there is a bi-directional causality between the two variables. Lastly, for both the equations with urbanisation and household size, the p-value is unidentified which shows that the causality between the two is unidentified as well.

6.6 IMPACT ANALYSIS: DIGITALISATION AND POVERTY

The fourth objective is on the effect of digitalisation on poverty in Zimbabwe, and in this research, panel ordinary least squares, fixed effects and random effects models and dynamic models were used in an attempt to comprehensively address the impact analysis given the conditions of the data being used. The pre-test conditions have shown that the data has been

resolved for multi-collinearity. However, heteroscedasticity and some non-stationarity were observed, hence the need for a robust array of estimation models to be used.

6.6.1 Panel OLS model

In bringing up a basic impact analysis of digitalization and poverty dimension, the panel ordinary least squares (OLS) technique was utilized, and its detail is depicted in Appendix 8 and in Table 6.5 as follows:

Table 6.5 The Panel ordinary least squares

Variable	Coefficient	T-Statistic	Probability
Log_DIG	0.1691	7.81	0.0000***
Log_ELE	0.0971	4.32	0.0000***
Log_HEA	-0.2205	-2.83	0.0050***
Log_HHSE	-7.3237	-5.00	0.0000***
Log_HSEQ	-0.1012	-4.94	0.0000***
Log_URB	0.1773	13.20	0.0000***
CONSTANT	1.5308	10.78	0.0000***

Source: Researcher's calculations (2023)

The panel OLS technique was used to express the significance of the linear relationship that each of the six independent variable has with the dependent variable, international wealth index Log_IWI, whereby IWI is a proxy for poverty. Log_DIG represents digitalization which is a composite of internet, cell-phone, TV and internet. Log_ELE represents the electricity variable. Log_HEA is proxy for health while Log_HHSE is for household size and Log_HSEQ represents house hold quality. Log_URB is urbanisation. The probabilities show that all the variables are significant explanatory variables at a (1%) level. The OLS regression shows that international wealth index has a positive relationship with digitalisation, electricity and urbanisation; while international wealth index has a negative relationship with health, household size and house quality.

However, Kono and Sato (2023) argued that OLS cannot control for time-invariant unobserved heterogeneity, such as individual-specific effects. This can lead to omitted variable bias if there are unobservable factors that are correlated with the independent variables. Both Fixed Effects Model and Random Effects Models account for time-invariant individual-specific effects, addressing this limitation of OLS. OLS is sensitive to multi-collinearity, where independent variables are highly correlated, as depicted in the correlation analysis in Section 6.3, and this can lead to inflated standard errors and difficulty in isolating the individual effect of each

variable. The FEM and REM are less sensitive to multi-collinearity because they account for individual-specific effects, reducing the risk of collinearity amongst the independent variables.

The next section presents the Fixed Effects Model (FEM) and Random Effects Model (REM) in order to expand on the impact analysis using models which are more efficient, less biased and more rigorous than OLS in panel estimation on the impact analysis of digitalisation and poverty.

6.6.2 Fixed Effects Estimation

Paparoditis (2010) posited that the fixed-effects estimation only uses data from people with numerous observations and estimates effects for variables that change across these observations. It is assumed that time-invariant individual-specific dummy variables can capture the effects of unchanging unmeasured factors. The results of the fixed effects estimations are shown in Appendix 9, and presented by Table 6.6.

Table 6.6 Fixed effects estimation

Independent Variable	**T-Value**	**P-Value**
Log_DIG	8.22	0.0000***
Log_ELE	7.28	0.0000***
Log_HEA	1.40	0.165
Log_HHSE	3.53	0.001***
Log_HSEQ	-1.33	0.187
Log_URB	1.40	0.164
CONSTANT	4.44	0.0000***
F(6. 136) =	112.62	
Prob > F	0.0000	
Number of observations	150	

Note: (*), (**) and (***) indicate 1%, 5% and 10% significance level, respectively

Source: Researcher's calculations (2023)

The results shown by Table 6.7 depict fixed effects showing a negative impact between international wealth index and house quality. The results show that there is a positive impact

between international wealth index, education, electricity, health, household size, and urbanisation. The fixed effects show that digitalisation, electricity, household size and the constant are significant variables at a (1%) level of significance, while the rest are not significant at (1%), (5%) and even (10%).

The information shows that a (1%) increase in digitalisation will result in a (14.29%) increase in international wealth index, ceteris paribus. A (1%) change in electricity will result in a (13.17%) increase in international wealth index, ceteris paribus. A (1%) change in health will result in a (16.088%) increase in international wealth index, ceteris paribus. A (1%) change in household size will result in a (64.74%) increase in international wealth index, ceteris paribus. A (1%) change in house quality will result in a (9.3%) decrease in international wealth index, ceteris paribus. A (1%) change in urbanisation will result in a (5.33%) increase in international wealth index, ceteris paribus. The constant term is 10.73, which means that if all explanatory variables are zero, the international wealth index will be at 10.73, ceteris paribus.

6.6.3 Redundancy Test (POLS and FEM)

A Haussmann test was used to choose which test to run between FEM and POLS. The null hypothesis of the Haussmann test is that the fixed effects model is appropriate. The results of the Haussmann test are shown in Appendix 11a and illustrated in Table 6.7 below. The adopted hypothesis is as follows:

Ho, = The ordinary least squares model is consistent and efficient (preferred)

Ha = The fixed effects model is consistent and efficient (preferred)

Table 6.7 Redundancy test for FEM

Test Summary	Chi Sq Statistic	Chi Sq Diff	Chi Sq Prob
Cross Section	149.64	6	0.000

Source: Researcher's calculations (2023)

The results from the manipulation given the data set as shown on Table 6.8 produced a p-value = 0.000, which is less than 0.05. With a p-value of 0.000, the null hypothesis is rejected in favor of the alternative. This suggests that there is a significant difference between the estimates obtained from the Fixed Effects and OLS models, which mean it is best to choose fixed effects as opposed to random effects.

The alternative hypothesis implies that the fixed effects model is consistent and has better efficiency than OLS. However, there is a possibility that it is more efficient than the random effects model. Hence, there is need to test the model in terms of the random effects model estimation, then gauge the more efficient and extra consistent estimator between the two, thereafter.

6.6.4 Random Effects

Qizilbash (2004) stipulated that fixed effects are the effects of variables that are supposed to have a constant effect on the result variable, whereas random effects are the effects of variables that have a variable effect on the end variable amongst groups or people. The results of the fixed effects estimation are shown in Appendix 10, and are presented in Table 6.8.

Table 6.8 Random Effects

Variable	**T-Value**	**P-Value**
Log_DIG	8.81	0.0000***
Log_ELE	5.80	0.0000**
Log_HEA	-0.97	0.3340
Log_HHSE	0.68	0.4595
Log_HSEQ	-1.49	0.135
Log_URB	10.17	0.0000***
CONS	5.35	0.0000***
Wald Chi 2 (6)	851.33	
Prob >chi2	0.0000	
Number of observations	150	

Note: (*), (**) and (***) indicate 1%, 5% and 10% significance level, respectively

Source: Researcher's calculations (2023)

The results shown by Table 6.8, which depicted the random effects estimation, show that there is a negative impact between international wealth index and health, and between international wealth index and house quality. The results show that there is a positive impact between international wealth index and digitalisation, electricity, household size, urbanisation and the constant. The fixed effects robustly show that digitalisation, electricity, urbanisation and the constant are significant variables at the (1%) level of significance, while health, household size and house quality are not significant at the (1%), (5%) and even (10%) levels of significance.

The information shows that (1%) increase in digitalisation will result in a (16.34%) increase in international wealth index, ceteris paribus. A (1%) change in electricity will result in an (11.21%) increase in international wealth index, ceteris paribus. A (1%) change in health will result in a (70%) decrease in international wealth index, ceteris paribus. A (1%) change in household size will result in a (12.2%) increase in international wealth index, ceteris paribus. A (1%) change in house quality will result in a (5.52%) decrease in international wealth index, ceteris paribus. A (1%) change in urbanisation will result in an (18.49%) increase in international wealth index, ceteris paribus. The constant term is 86.72, which means that if all explanatory variables are zero, then the international wealth index will be at 86.72, ceteris paribus.

6.6.5 Choice between FE and RE (Haussmann test)

In this study, a Haussmann test was used to choose which test to run between fixed effects and random effects. The null hypothesis of the Haussmann test is that the fixed effects model is appropriate. The results of the Haussmann test are shown in Appendix 11b and illustrated in Table 6.9 below. The adopted hypothesis is as follows:

Ho, = The random effects model is consistent and efficient (preferred)

Ha = The fixed effects model is consistent and efficient (preferred).

Table 6.9 Haussmann Test for REM and FEM

Test Summary	Chi Sq Statistic	Chi Sq Diff	Chi Sq Prob
Cross Section	305.43	6	0.000

Source: Researcher's calculations (2023)

The results from the manipulation, given the data set as shown on Table 6.8, produced a p-value = 0.000, which is less than 0.05. With a p-value of 0.000, the null hypothesis is rejected

in favor of the alternative. This suggests that there is a significant difference between the estimates obtained from the Fixed Effects and Random Effects models, which means that it is best to choose fixed effects as opposed to random effects.

However, Arellano and Bond (1991) purported that FEM assumes that the individual-specific effects are constant over time and that if there are concerns about endogeneity (correlation between the individual-specific effects and the regressors), the Generalized Methods of Moments (GMM) provides a way to address this issue through the use of instruments. GMM is particularly well-suited for dynamic panel data models where lagged values of the dependent variable and instruments are included. FEM may have limitations in accommodating the dynamic aspects of the data. Roodman (2009) argued that GMM can be more efficient than FEM in the presence of heteroscedasticity and when there are more valid instruments available. It allows for a more flexible treatment of the instruments used in the estimation. GMM is able to handle issues of potential measurement error, unobserved heterogeneity and endogeneity, (Roodman, 2014). The next section therefore focuses on GMM.

6.6.6 The General Method of Moments (GMM) Model

The data in this study presents a time span of fifteen years (T<30) and a large number of observations (N=150), which is a sound platform to harness Generalized Methods of Moments (GMM) in the analysis of the impact of digitalisation on poverty in Zimbabwe. This section presents the model specification, which is GMM.

Gauss (1809) stated that a generalized method of moments (GMM) is a statistical method for estimating the unknown parameters of an economic model by combining actual economic data with information from population moment conditions. Arellano and Bond (1991) amplified the difference GMM estimation while Blundel and Bond (1998) and Arellano-Bover/Blundel-Bond (1998) furthered it up to the System GMM. The GMM were manipulated using Stata, and the results are shown in Table 6.6.1 for Difference GMM at level and 6.6.2 for System GMM.

6.6.6.1 Difference GMM

The Difference GMM is a statistical method for estimating the unknown parameters of an economic model by combining actual economic data with information from population moment conditions, without incorporating lags. The results from level GMM are presented in Table 6.10.

Table 6.10 Difference GMM

Variable	Coefficient	P-Value
Log_IWIL1	0.5520	0.0000***
Log_DIG	0.1124	0.0010***
Log_ELE	0.0254	0.1250
Log_HEA	-0.1020	0.2280
Log_HHSE	0.1846	0.2180
Log_HSEQ	0.0257	0.7010
Log_URB	0.0226	0.5340
CONSTANT	0.0279	0.0490
Sargan: Chi2 (84) =	181.7336	
Prob > Chi2 =	0.0000	
Wald : Chi 2 (7) =	1354.73	
Prob > Chi2 =	0.000	

Note: (*), (**) and (***) indicate 1%, 5% and 10% significance level, respectively

Researcher's calculations (2023)

The results above show that only a lagged international wealth index and digitalisation are significant at the (1%) level of significance, while the constant is significant at a (5%) level of significance in the level GMM model. The rest of the five variables are not significant determinants of international wealth index, which is a source of concern in this model. In terms of the direction of impact, only health has a negative impact on international wealth index, while the rest of the variables have a positive impact on international wealth index.

In an attempt to harness the endogeneity problem, the regressors are transferring through differencing by removing fixed effects. However, the subtraction of previous observations from the contemporaneous ones magnifies gaps in the panels, which results in poor performance of the difference GMM estimators. As noted by Blundel and Bond (1998), poor performance of the Difference GMM estimators is attributed to the use of poor instruments. The poor performance of the Difference GMM due to poor instrumentation, magnification of gaps, and existence of heteroscedasticity may be resolved by use of a System GMM, but before using it, its enabling conditions have to be checked first, as shown in the next section.

6.6.6.2 Enabling conditions of graduating from Difference GMM to System GMM

Arellano and Bover (1995) and Blundel and Bond (1998) advanced that a System GMM is a dynamic panel data estimator which may correct endogeneity by introducing more instruments

in order to dramatically improve efficiency. It transforms the instruments to make them uncorrelated with fixed effects, using orthogonal deviations to minimize the loss of data. The System GMM has the potential of satisfying the Monte Carlo conditions, which suggests that when T is short and the dependent variable is persistent, there are gains in precision and small sample bias is reduced.

In the presence of a heteroscedasticity and serial correlation, a Two-Step System GMM estimator should be used by exploiting a weighted matrix using residuals from the first step, when standard errors tend to be downward biased, in line with the Windmierjer adjustment in order to correct small sample adjustments by comparing Pooled OLS and Fixed Effects estimators.

Upon comparing Pooled OLS and FEM and Difference GMM, the coefficient of the digitalisation, which is the main crux of the matter in the GMM Difference, is way below the coefficient of digitalisation in the REM. Hence it is advisable to use System GMM, which will take both endogenous and predetermined variables are present in the model, as shown in Table 6.11. System GMM uses both lagged levels and first-differences of the endogenous variables as instruments and hence resolves the indigeneity problem and brings about efficient estimation when the time-frame is small and N is large.

Table 6.11 Comparison of coefficients of POLS, REM, FEM and GMM

	POLS	FEM	REM	GMM Difference
Variable				
Log_DIG	0.1691	0.1429	0.1634	0.1124
	0.0000***	0.0000***	0.0000***	0.0001***

Note: (*), (**) and (***) indicate 1%, 5% and 10% significance level, respectively

Source: Researcher's Calculation (2023)

If the coefficient of the dependent variable international wealth index in Difference GMM is smaller or equal to that of REM, it is advisable to use system GMM.

6.6.6.3 System GMM

System GMM was used to resolve the problems of poor instrumentation found in Difference GMM, alongside the problems of heteroscedasticity found in the data set, as well as auto-correlation between dependent variable and residuals, as purported by Arellano and Bover (1995) and Blundel and Bond (1998). The System GMM computed produced the following results as presented in Table 6.12.

Table 6.12 Systems GMM - Arellano-Bover/Blundell-Bond Estimator

Variable	Step One System GMM	Step Two System GMM
Log_IWIL2	n/a	0.5233
		0.0020***
Log_IWIL1	0.5968	-0.2503
	0.0000***	0.081
Log_DIG	0.1317	0.3031
	0.0000***	0.0000***
Log_ELE	0.03267	0.0684
	0.0090***	0.0000***
Log_HEA	-0.1285	-0.3856
	0.0058***	0.0000***
Log_HHSE	0.4002	0.5175
	0.0000***	0.0000***
Log_HSEQ	0.03048	-0.0086
	0.3780	0.8200
Log_URB	0.0084	0.0507
	0.7190	0.045
Sargan: Chi 2 (95) =	251.2315	221.178
Prob > Chi2 =	0.0000	0.0000
Wald: Chi2 (7)	698098.08	694593.15
Prob > Chi2 =	0.0000	0.0000

Note: (*), (**) and (***) indicate 1%, 5% and 10% significance level, respectively

Source: Researcher's calculations (2023)

Table 6.11 above shows Step One System GMM and Step Two System GMM. In Step One GMM, the variables, which include lagged international wealth index, digitalisation, electricity, health and household size, are statistically significant at a (1%) level of significance in relation of being significant determinants in the model. House quality and urbanisation are statistically insignificant at (1%), (5%) and (10%), which proves that they are insignificant determinants in the model.

In the Step Two System GMM, digitalisation, electricity, health and household size are statistically significant at a (1%) level of significance, which indicates that they are significant determinants in the model. Urbanisation is statistically significant at the (5%) level of significance, which indicates that it is also a significant determinant in the model.

In the One Step System GMM, a one-unit increase in the previous period international wealth index is associated with, on average, a (59.68%) increase in the change of the contemporaneous international index, holding other variables constant. A one-unit increase in digitalisation is associated with, on average, a (13%) increase in the change of the international wealth index, holding other variables constant. A one-unit increase in electricity is associated with, on average, a (3.2%) increase in the change of the international wealth index, holding other variables constant. A one-unit increase in health is associated with, on average, a (12.85%) decrease in the change of the international wealth index, holding other variables constant. A one-unit increase in household size is associated with, on average, a (40.02%) increase in the change of the international wealth index, holding other variables constant. A one-unit increase in house quality is associated with, on average, a (3.04%) increase in the change of the international wealth index, holding other variables constant. A one-unit increase in urbanisation is associated with, on average, a (71.9%) increase in the change of the international wealth index, holding other variables constant.

In the Two Step GMM, a one-unit increase in the two period lagged international wealth index is associated with, on average, a (52.33%) increase in the change of the contemporaneous international wealth index, holding other variables constant. A one-unit increase in the one pegged international wealth index is associated with, on average, a (25.03%) decrease in the change of the contemporaneous international wealth index, holding other variables constant. A one-unit increase in digitalisation is associated with, on average, a (30.31%) increase in the change of the international wealth index, holding other variables constant. A one-unit increase in electricity is associated with, on average, a (6.84%) increase in the change of the international wealth index, holding other variables constant. A one-unit increase in health is associated with, on average, a (38.56%) decrease in the change of the international wealth index, holding other variables constant. A one-unit increase in household size is associated with, on average, a (51.76%) increase in the change of the international wealth index, holding other variables constant. A one-unit increase in house quality is associated with, on average, a (0.86%) increase in the change of the international wealth index, holding other variables constant. A one-unit increase in urbanisation is associated with, on average, a (5.07%) increase in the change of the international wealth index, holding other variables constant.

The results that digitalisation is a significant determinant, positive strong associate and having a bi-causal relationship to poverty, agrees with the general trend of results from Yılmaz *et al.* (2018), Ma *et al.* (2018), Martinez (2020), Alim and Okunade, (2020), Akinboade *et al.* (2021), Yang *et al.* (2021), Mateko (2022), Olamide et al (2022), amongst others. However, most of these authors utilised variegated methodologies, models, research areas, spatiality scopes, etcetera from this foregoing study.

6.7 POST ESTIMATION TESTS

A number of post estimation tests were carried out so that the results can be tested for serial correlation, indogeneity validity, reliability and consistence.

6.7.1 Over identification of instruments (Sargan Test)

Hansen's (1982) J test and Sargan (1985) tests are for checking over identifying restrictions. The Sargan test is a diagnostic test used after estimating a model using GMM with instrumental variables. It tests whether the over-identifying restrictions on the instruments are valid. These restrictions are imposed to ensure that the instruments used are uncorrelated with the error term after instrumenting for the endogenous variables. The hypothesis for the Sargan Tests is as follows:

> **Null Hypothesis** H_0: The over-identifying restrictions are valid (instruments are uncorrelated with the error term).
>
> **Alternative Hypothesis** H_1: The over-identifying restrictions are not valid.

The Sargan tests performed on the One Step System GMM and the Two Step System GMM produced a p-value of 0.000. The Sargan Test p-value of 0.000 means that the over identification restrictions are not statistically significant, hence there is no evidence to reject the null hypothesis, indicating that the instruments are valid. On the other hand, a significant p-value might suggest a problem with the instruments, which is not the case in this result. The Sargan Tests are shown in Appendix ….

6.7.2 Joint Linear Combinations Test (Wald Test)

The Wald Test is a hypothesis test that evaluates whether a linear combination of coefficients is equal to a specified value. The test statistic is calculated as the ratio of the estimated coefficient vector to its estimated standard errors, and it follows a chi-squared distribution under the null hypothesis. The hypothesis for the Wald Tests are as follows:

Null Hypothesis H_0: The linear combination of coefficients is equal to the specified value.

Alternative Hypothesi: H_1: The linear combination of coefficients is not equal to the specified value.

The results from the Wald Test in the One Step Systems GMM and Two Step Systems GMM showed a p-value of 0.000, which means that the null hypothesis is rejected. This suggests that the specified linear combination of coefficients is statistically significantly different from the specified value, providing evidence of joint significance or non-equality. That means that the estimated coefficients are highly unlikely to have occurred by random chance alone. The Wald test are shown on Appendices 13 and 14.

6.7.3 Arellano Bond Serial Auto Correlation

Arellano and Bond (1991) stipulated that dynamic panel models should not suffer from serial correlation. The association between a given variable and a lagged version of itself over time intervals is known as serial correlation. It assesses the link between a variable's present value and its previous values. The results from testing for serial correlation using the Arellano-Bond Serial Correlation test are shown in Appendix 15 and are presented in Table 6.12

Table 6.13 Arellano-Bond Serial Auto Correlation Test

Test Order	m-Statistic	P-Value
AR (1)	1.23	0.220
AR (2)	-0.01	0.996

Source: Researcher's calculations (2023)

The hypothesis adopted for AR(1) are as follows:

Null Hypothesis H_0: There is no first-order autocorrelation in the residuals (the autocorrelation parameter is zero).

Alternative Hypothesis H_1: There is first-order autocorrelation in the residuals (the autocorrelation parameter is not zero).

The AR (1) p-value of 0.220 is greater than the common significance level of 0.05, which means that the results typically fail to reject the null hypothesis. This suggests that, based on the available evidence, there is no statistically significant indication of first-order autocorrelation in the residuals.

The hypothesis adopted for AR(2) is as follows:

> **Null Hypothesis** H_0: There is no second-order autocorrelation in the residuals (the autocorrelation parameter for lag 2 is zero).
>
> **Alternative Hypothesis**: H_1: There is second-order autocorrelation in the residuals (the autocorrelation parameter for lag 2 is not zero).

The AR (1) p-value of 0.220 is greater than the common significance level of 0.05, and it follows that the null hypothesis is also rejected. This suggests that, based on the available evidence, there is no statistically significant indication of second-order autocorrelation in the residuals. In practical terms, a p-value of 0.990 indicates that the result is not considered statistically significant at the 0.05 level, and there is no strong evidence to suggest the presence of second-order autocorrelation.

6.8 CHAPTER SUMMARY

This chapter highlighted the presentation of empirical results. The main inquiry of the research was to investigate the relationship between digitalisation, which is a composite index consisting of internet, cell-phone and computer indexed through the principal component analysis and poverty represented by the international wealth index. The apriori expectations are that digitalisation reduces poverty, and the notion has been supported by a number of researchers, who include Yılmaz *et al*. (2018), Ma *et al.* (2018), Martinez, (2020), Akinboade *et al.* (2021); Mateko, (2022), Olamide *et al.* (2022), etcetera. Schumpeter (1911) forwarded the model that innovation reduces poverty. The results from the SGMM revealed that digitalisation is a significant determinant of international wealth index at (1%) significance level, with an elasticity of 0.30.

The chapter commenced by presenting the descriptive statistics and then correlation analysis which sought to illustrate and answer the first objective, questioning if there is a relationship between poverty and digitalisation. The correlation results showed that indeed there is a relationship. However, the need to present causality relationships and model parameters for the impact analysis required some pre-estimation test to be carried out. The results from the correlation analysis align to apriori expectations. However, the need to expose impact analysis ushered the empirical investigation to empirical models, although beforehand some pre-estimation test were unavoidable.

Multi-collinearity was tested using the variable inflation factors, and the results which showed the existence of a multi-collinearity problem was resolved by converting the observations of

the data into logarithmic form as well as pruning out the EDU variable and the ASSET independent variables, and hence reducing the independent variables to six. Heteroscedasticity and stationarity were tested, and the data proved to be heteroscedastic, but stationary to the Hadri M test, and partly with Levin-Lin Chu test and Fischer ADF tests. OLS, FEM and REM estimations were carried out and a Haussmann test resulted in REM being chosen.

The FEM, REM and Difference GMM were subjected to the Windmeijer condition and proved that the System GMM was appropriate for the model estimation. The System GMM, One Step and Two Step were performed and produced plausible results which showed that indeed DIG impacts IWI even in lagged periods. Post estimation tests were carried out and it was confirmed through the Sargan Test that indeed the data over identification restrictions were not valid, and the Wald test proved that the linear coefficients were not equal to specified values, hence non-equal aspect was present. The System GMM model, through Arellano and Bond's (1991) auto-correlation or serial correlation test, proved that there was no first order autocorrelation as well as no second order autocorrelation in residuals. The next chapter will forward conclusions, recommendations and areas for further study.

CHAPTER 7

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

7.1 INTRODUCTION

This chapter presents the concluding aspects of the research project. The crux of the matter in this study was to establish and analyse the relationship between poverty and digitalization in Zimbabwe. The summary of the study and general conclusions drawn from the empirical results are provided. Policy recommendations are suggested in line with the empirical findings whilst taking cognizance of a priori conditions. The contributions of this study to the body of knowledge and literature are espoused, while limitations and areas for future studies are established.

7.1 SUMMARY OF THE STUDY

The paramount objective of this study was to unravel the multifaceted connection between poverty and digitalization within the context of Zimbabwean provinces. The research study commenced by seeking a research gap, which was identified as very few studies, if any, having ever been researched on digitalisation and poverty dimensions in Zimbabwe at the provincial level, using secondary data. Various sources including the UN, (2016), UNFPA (2018), Songwe (2020), UNCTAD (2021), etcetera have produced details that poverty levels in Zimbabwe have been on the rise since the year 2000, and the quest was to understand if there is any relationship with digitalisation as all economies enter the fourth industrial revolution. ICT policies have been crafted in 2005 and reviewed in 2016, and digitalisation trends such as mobile subscriptions and the internet have been observed to be on the rise (World Bank, 2020). Schumpeter's (1911) theory elucidated that innovation may reduce poverty, as much as Lewis (1966) hinted that poverty cycles can be broken from being transmitted from generation to generation, and the key probe is whether the internet generation may utilize digitalisation to break the poverty cycle in the context of a Sub-Saharan country, Zimbabwe.

The study perused several theoretical foundations such as Schumpeterian, Monetary theory and Social Exclusion to mention but a few, on poverty and digitalisation and/or information and communication technology/technology. The classical theories such as Schumpeter's (1911) aver that innovation can reduce poverty. Definitions of poverty were fathomed, with Sen (1976) providing a tangible aspect on multidimensional poverty, as later supported by Sen, Shorrocks and Thon (1983) as well as Foster, Greer and Thormbeck (1984). Lardechi et al. (2003) and Barrantes (2007) provided a plausible aspect on definitions of digitalisation and

digital poverty. Empirical reviews were explained, although there was lack of empirical literature on the topic in Zimbabwe. However, similar studies in Africa and the World brought the debate to life, and the gaps in empirical literature were discussed.

A methodology section was detailed, baselined by the positivism philosophy and a Stiglitz-Sen-Fetoussi (2009) conceptual framework, whereby the focus was on addressing the four research objectives. The first objective was methodically addressed by correlation analysis, and the second through stylized facts analysis on Zimbabwe provinces pertaining to digitalisation and poverty. The third objective was methodically marveled using the Dimistrescu-Hurlin causality test, while the impact analysis, which was the last objective, focussed on OLS, FEM, REM and GMM models, which were pre-estimation tested and post-estimation tested in order to establish reliability, validity and consistency.

A results section was expounded, which brought to life the facts from the manipulation of the secondary data obtained from Global Data Labs (2023) and World Bank (2023), using Stata statistical software. The summary results produced were that there indeed is a positive moderate relationship between the international wealth index representing poverty and digitalisation in terms of correlation analysis, with a coefficient of 0.6. This implies that an increase in digitalisation increases wealth, thereby reducing poverty. Digitalisation and the international wealth index were found out to have a bi-causal relationship at a (1%) significance level, and from the SGMM models, the results showed that digitalisation is indeed a determinant of the international wealth index. The summary provides the idea that digitalisation reduces poverty, which aligns with apriori expectations.

Analysing the relationship between poverty and digitalisation is crucial for several reasons, namely: reflecting the profound impact of digital technologies on socio-economic development and the well-being of individuals and communities. Understanding the relationship between poverty and digitalisation is essential for fostering inclusive development. Digital technologies have the potential to bridge gaps in access to information, education, healthcare and economic opportunities, thereby contributing to the empowerment of marginalized and underserved populations. Insights from studies on poverty and digitalisation inform evidence-based policy formulation. Policy-makers can leverage the research findings to design targeted interventions and initiatives that harness the transformative power of digital technologies to alleviate poverty, promote economic growth, and enhance overall well-being.

7.2 GENERAL CONCLUSIONS

The main objective of the study was to ascertain whether there is a relationship between digitalisation and poverty in Zimbabwe's ten provinces. The results from the stylized facts

analysis about digitalisation and poverty in Zimbabwe showed that the provinces of Zimbabwe have differences in terms of digital uptake. Urban centres such as Bulawayo and Harare presented high rates of digitalisation as opposed to far-off rural provinces, which one may term as poor and marginalised societies. A positive relationship between digitalisation and the international wealth index was established, which converges with results from previous researchers such as Yilzman *et al.* (2018), Ma *et al.* (2018), Yang et al (2021), Olamide *et al.* (2022), amongst other. These results disagree with Alimi and Okunade (2020) who posit that in the short-run, there is no association between ICT and poverty. Upon pre-estimation testing, the data suffered from multicollinearity and heteroscedasticity, and the researcher had to prune off education and asset variables. The international wealth index and digitalisation was found to have a bi-directional causality at a (1%) significance level, which reflects that indeed digitalisation may cause poverty in Zimbabwe, hence the need to sensitise people.

The correlation analysis conducted between the international wealth index and digitalisation showed a strong positive relationship, which explains that if digitalisation policies are well informed and there is an increase in digitalisation, there is a strong possibility of poverty being reduced from a provincial basis to the Zimbabwean economy. The association between the international wealth index and digitalisation was further cemented by the results from the Dimistrescu-Hurlin causality test, whereby a bi-causal relationship was established at the (1%) significance level. This showed that if digitalisation increases, the international wealth index also increases; and if digitalisation decreases, the international wealth index follows suit. The results converge with the Schumpeterian innovation model which indicated that innovative technologies such as digitalisation may significantly reduce poverty. Digitalisation can indeed be harnessed to reduce costs, enhance productivity, increase efficiency in communication, business networks, research and other issues, which provides more reasons for the Government of Zimbabwe to increase investments into digital technology, and increase annual budgets for the Ministry of ICT, as well wel other ministries that utilise digital technology.

It goes without saying that if digitalization, which is in terms of the internet, cell-phones and computers being the digitalisation aspect, and the international wealth index have a positive bi-causal relationship, that could lead to a positive feedback loop. Increased digitalization may contribute to economic development, leading to higher wealth levels and thereby reducing poverty, and vice versa. This positive loop can amplify the effects, fostering further economic growth. To an economy such as Zimbabwe, digitalization can improve efficiency, connectivity, and access to information and markets. The positive effect is that it could lead to increased productivity and economic growth, contributing to higher wealth levels amongst individuals and businesses. The strength and nature of the bi-causal relationship can influence the pace

and extent of technological adoption in the economy. A positive relationship may encourage businesses and individuals to invest in digital technologies, anticipating positive effects on wealth. The results converge with Mateko (2022), Olamide et al (2022) and others, and as such creates impetus to promote digitalisation through an increase in investment in ICT in provinces which have high poverty rates, such as Matebeleland North and South.

The results showed that digitalisation is a significant determinant of international wealth at the (1%) significance level. The implications of digitalization being a significant determinant of international wealth are wide-ranging and transformative, including but not limited to the idea that increased digitalization can lead to economic growth and prosperity, thereby reducing poverty. Digital technologies can enhance productivity, efficiency and innovation across various sectors, contributing to higher income levels and overall wealth in a country, and in this case from a provincial level. The positive coefficient suggests that policies or interventions promoting digitalization could potentially contribute to an increase in the international wealth index. Decision-makers may consider investing in digital infrastructure, education and technology to enhance economic prosperity. Pocock's (1957) social exclusion theory being read with Lewis' (1966) theory on the culture of poverty succinctly provides understanding on why the poor remain poor if the poverty cycle is not broken. The results point out that digitalisation is a significant determinant of wealth, which implies that any aspect of digitalisation therein provided, such as the internet, computers and cell-phones, irrespective of model and prices, may result in reductions in poverty. The economic agents are therefore encouraged to make a corrective choice between brick and mortar versus digital modes in production, marketing, procurement, communication and the like, in order to break the poverty cycle.

Electricity, health and household size were equally found to be significant determinants of the international wealth index, the proxy for the poverty dimension in this study. Hence they are important aspects when advising on policies meant to reduce poverty, especially in developing economies such as Zimbabwe, from grassroots levels such as provinces. Electricty is an enabler of ICT and digitalisation, as agreed upon by Ma *et al.* (2018). A healthy society is able to participate in economic activities effectively and thereby eradicate poverty, as also highlighted by the WHO (2020). Household size plays an important role in fighting poverty, as forwarded by Martinez (2020) who iterated that most African households have a mandate to control family size in order to reduce the dependency ratio per breadwinner.

7.3 POLICY RECOMMENDATIONS

The following are recommendations advocated by the researcher:

- Policy-makers may need to consider the bi-directional relationship when formulating strategies for economic development and digitalization. Policies that promote both digital inclusion and wealth creation IN all provinces in Zimbabwe can be more effective in fostering sustainable and inclusive economic growth. High levels of digitalisation were found in the metropolitan provinces of Harare and Bulawayo, but the clarion call is to engage policies that stimulate digital infrastructure in rural areas and peri-urban areas, which will create digital inclusion for all provinces irrespective of level of urbanisation or spatiality.

- Policy formulation is required in the implementation of comprehensive digital literacy and skills development programs targeted at low-income areas such as Matebeleland North, Matebeleland South, Mashonaland West and the like. These programs should focus on building essential digital skills such as internet literacy, proficiency in using mobile phones and computers, and understanding the benefits of digital technologies for socio-economic advancement.

- Policy constructs on affordable access to digital infrastructure including the internet, mobile phones and computers, particularly in rural and underserved areas are recommended. A policy framework is recommended to address the issue of the monetary affordability of internet data and speed of connectivity, be it broadband or fixed-line internet connections, as this will address the access and quality part of it. Government initiatives and public-private partnerships can be leveraged to expand digital connectivity and reduce the digital divide.

- ICT policies on the promotion of smart technology and its enabler gadgets amongst the population, most notably computers, cell-phones and their related cohorts such as tablets. This involves promoting the use of smart devices, applications and technologies that can enhance productivity, access to information, and participation in the digital economy. ICT policies are recommended to address the issue of having ICT for productivity beyond ICT know-how, where applications are bringing reduced costs, increased speed of access, information sharing, and resolving complicated phenomena such as financial markets, mathematics and science issues, amongst others.

- Energy policies in conjunction with the ICT policies are recommended to elaborate ON and take cognizance of access to electricity initiatives which are meant to improve

access to electricity in poverty-prone regions such as rural dwellings and growth point centers of non-metropolitan provinces in Zimbabwe. The study identified electricity as a significant determinant of poverty, and efforts to enhance electricity infrastructure can contribute to creating an enabling environment for digitalisation. Digitalisation gadgets require electrical power, and efforts to address access, availability and affordability of electric power and its types is an enabler to digitalisation efforts. Ideas to harness the abundant solar energy in Zimbabwe, refurbish hydroelectric power stations at Kariba Dam, refurbish Hwange Thermal Power Station and Munyati Thermal Power Station are recommended as efforts towards improving digitalisation and hence eradicating poverty.

- Rural development and urbanisation policies which make the prioritization of urbanisation and infrastructure development in a manner that fosters inclusive growth are highly recommended. Urbanisation was identified as a significant and positively associated determinant of poverty, and strategic planning for urban development can create opportunities for improved living conditions and access to digital resources.

- Tailored digital interventions policies for the specific needs and challenges of different provinces is recommended. Recognizing the regional variations highlighted in the study such as urban versus rural, customizing digital initiatives can ensure relevance and effectiveness in addressing poverty at the local level.

- Multi-sectoral collaboration through fostering collaboration amongst government agencies, private sector entities, non-governmental organizations (NGOs) and academic institutions is recommended. A multi-sectoral approach is essential in order to address the complex dynamics of poverty and digitalisation, leveraging diverse expertise and resources.

- Monitoring and evaluation framework: establish a robust monitoring and evaluation framework to assess the impact of digitalisation initiatives on poverty alleviation. Regular evaluations can help policy-makers make data-driven decisions, refine strategies, and ensure that interventions are achieving the desired outcomes.

- Inclusive research and data collection: promote inclusive research methodologies and data collection strategies that capture the experiences and perspectives of individuals living in poverty. This includes engaging with local communities to understand their unique challenges and incorporating their insights into policy design.

- Continued research and adaptation and support: continued research initiatives to monitor the evolving relationship between digitalisation and poverty is recommended in modern day institutions. Tertiary institutions and research institutions are recommended to have a department or faculty tailor-made to addressing the evolving relationship between digitalization and poverty, more especially in this ever-changing technological world congested by disruptive internet technology. Given the dynamic nature of technology and socio-economic conditions, policy-makers should stay informed about emerging trends such as disruptive digital technologies, and be ready to adapt policies accordingly.

- Investment in digital infrastructure in low-income areas is encouraged to enhance economic inclusion.

These recommendations aim to create an enabling environment for leveraging digitalisation as a catalyst for poverty alleviation in Zimbabwe's ten provinces, and even in other similar economies. By adopting a holistic and targeted approach, policy-makers can harness the transformative potential of digital technologies to build a more inclusive and sustainable future for all citizens.

7.4 CONTRIBUTION OF THIS STUDY TO EXISTING LITERATURE

This study significantly contributes to the existing body of knowledge and literature on the nexus between poverty and digitalization. By unravelling the specific nuances within the Zimbabwean context, this research adds a valuable layer to the global discourse on leveraging digital technologies for socio-economic development. Scholars, policy-makers and practitioners alike can draw upon this study's findings to inform their understanding of how digitalization can be harnessed as a tool for poverty alleviation

7.4.1 Multi-dimensions of Poverty

The multidimensional poverty indices, which aim to provide a more comprehensive understanding of poverty by capturing the diverse aspects of people's lives that contribute to their well-being in as developed by the United Nations Development Programme (UNDP) and the Alkire-Foster methodology, are anchored on education, health, and standard of living**.** After getting results on how vital is digitalisation is to reduction of poverty, this researcher hopes that in the future, an addition to the dimensions may include digitalisation to the MPIs, in view of the futuristic cyber world.

7.4.2 Bread basket debate

Zimbabwe's database on calculations of the bread basket and hence policy constructs which utilise the bread basket such as fiscal and monetary policy, humanitarian policies etc, are recommended for a review in light of this needful aspect to be inculcated in the bread basket.

7.4.3 Disruptive technology acquaintance

This research adds to the body of knowledge based on disruptive technology. Disruptive technology refers to innovations that significantly alter or revolutionize an industry, such as electronic commerce, artificial intelligence, crypto-markets and crypto-currencies, which are all off -hoots of the digitalisation knowledge base. These technologies often replace existing products, services or business models, leading to a fundamental shift in the way things are done and are a futuristic world engagement, which is unstoppable.

7.4.4 Understanding the Impact Analysis of Digitalisation

Research can provide insights into how digitalization influences poverty levels. Understanding the impact of digital technologies on economic opportunities, income distribution and access to resources is crucial for policy-makers, practitioners and researchers. This research will add to the body of knowledge on the impact analysis of digitalisation on poverty, and hence appropriate policy insights can be crafted.

7.4.5 Identifying Mechanisms

Examining the mechanisms through which digitalization affects poverty allows for a nuanced understanding. This includes studying how increased connectivity, access to digital skills and the use of digital platforms contribute to poverty reduction or exacerbation. More exposition is needed in the era post the year 2000 to understand the importance of digitalisation in all spheres of life.

7.4.6 Inclusive Economic Growth

Understanding the relationship between digitalization and poverty helps in promoting inclusive economic growth. Research can shed light on how to harness digital technologies to ensure that the benefits are distributed more equitably across different socioeconomic groups.

7.4.7 Digital Divide Debates

Investigating the digital divide—unequal access to digital resources and technologies—can highlight disparities in opportunities. This knowledge is essential for policy-makers aiming to bridge the digital divide and create more inclusive societies. Many people in developing countries rely on informal economies. Research can explore how digitalization influences

informal economic activities, job creation, and the livelihoods of individuals engaged in these sectors.

7.4.8 Technological Innovation and Entrepreneurship

This study adds to research detail that explores the role of digitalization in fostering technological innovation and entrepreneurship, which alleviate poverty, especially in Sub Saharan African countries. Understanding how digital technologies empower individuals to start businesses, access markets and create economic value contributes to a broader understanding of poverty dynamics.

7.4.9 Socioeconomic Empowerment

Digitalization has the potential to empower individuals socially and economically. Research can highlight success stories, best-practices and challenges faced by individuals using digital technologies to improve their socioeconomic status.

7.4.10 Long-Term Trends and Globalisation

By examining long-term trends, research can provide insights into the evolving relationship between digitalization and poverty. This understanding is crucial for anticipating future challenges and opportunities. Comparative studies across different regions and countries can provide a global perspective on the impact of digitalization on poverty. This helps in identifying common patterns, regional variations and lessons that can be shared across borders.

7.5 AREAS FOR FURTHER STUDIES

This research had some limitations which the researcher believes are a foundation for future areas of study. This study utilised a time span of 15 years, from 2006 to 2020, and a dynamic panel data model was used. However, there is more scope on getting data for Zimbabwe which spans for more than 15 years, and in that futuristic study, long-term and short-term equilibria can be ascertained. This research may also be engaged using a primary data methodology instead of secondary data. The researcher also recommends that similar studies can be done on some sub-Saharan countries such as Zambia, South Africa, etc. to compare results. The explanatory variables chosen were only eight, which were adjusted to six. This only gives scope for a narrower analysis, and there is scope for a wider array of factors to be used in similar studies elsewhere.

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0 APPENDICES

Appendix 1: Summary statistics

```
. summarize dig   iwi edu ele asset hea hhse hseq urb
```

Variable	Obs	Mean	Std. Dev.	Min	Max
dig	150	55.76115	27.04456	6.087525	117.7918
iwi	150	41.0978	14.71662	19.39	84.745
edu	150	.5757933	.0661336	.453	.739
ele	150	40.4943	27.04709	10.47	98.19
asset	150	18.00966	13.72304	3.938547	52.57112
hea	150	.5511067	.1011955	.342	.699
hhse	150	5.55135	.4206	4.68	6.84
hseq	150	10.2277	3.631306	4.75	17.6775
urb	150	30.8782	34.56966	5.4	100

Appendix 2: Skewness and Kurtosis (dispersion extended)

```
. sktest dig iwi edu ele asset hea hhse hseq urb

                    Skewness/Kurtosis tests for Normality
                                                      ------- joint ------
    Variable |   Obs   Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)    Prob>chi2
-------------+------------------------------------------------------------
         dig |   150       0.4145         0.0063         7.49         0.0236
         iwi |   150       0.0000         0.3714        20.31         0.0000
         edu |   150       0.0010         0.9801         9.49         0.0087
         ele |   150       0.0000         0.3297        17.24         0.0002
       asset |   150       0.0000         0.4202        22.09         0.0000
         hea |   150       0.0742         0.0000        46.21         0.0000
        hhse |   150       0.4087         0.9126         0.70         0.7035
        hseq |   150       0.7569         0.0000        29.08         0.0000
         urb |   150       0.0000         0.5960        25.29         0.0000

. spearman dig tv edu ele asset hea hhse hseq urb, stats(rho p) print(0.10) star(0.05) pw
(obs=150)
```

Appendix 3: Spearman Rank Correlation Coefficient

```
. correlate iwi dig edu ele hea asset hhse hseq urb
(obs=150)
```

	iwi	dig	edu	ele	hea	asset	hhse	hseq	urb
iwi	1.0000								
dig	0.6211	1.0000							
edu	0.9016	0.7578	1.0000						
ele	0.9383	0.5315	0.8472	1.0000					
hea	0.3221	0.8582	0.4319	0.2418	1.0000				
asset	0.9559	0.6530	0.9093	0.9527	0.3763	1.0000			
hhse	-0.7003	-0.7164	-0.8207	-0.6597	-0.4233	-0.7161	1.0000		
hseq	0.0901	0.2471	0.3820	0.0920	-0.0678	0.0759	-0.3833	1.0000	
urb	0.9395	0.4114	0.8214	0.9223	0.0987	0.9176	-0.5635	0.1043	1.0000

Appendix 4: Dimitrescu & Hurlin Causality For Digitalisation and Poverty

```
. xtgcause  log_iwi log_dig


Dumitrescu & Hurlin (2012) Granger non-causality test results:
------------------------------------------------------------------
Lag order: 1
W-bar =           2.5415
Z-bar =           3.4470    (p-value = 0.0006)
Z-bar tilde =     2.0194    (p-value = 0.0434)
------------------------------------------------------------------
H0: log_dig does not Granger-cause log_iwi.
H1: log_dig does Granger-cause log_iwi for at least one panel (prov).

. xtgcause  log_dig log_iwi


Dumitrescu & Hurlin (2012) Granger non-causality test results:
------------------------------------------------------------------
Lag order: 1
W-bar =           4.0736
Z-bar =           6.8728    (p-value = 0.0000)
Z-bar tilde =     4.3645    (p-value = 0.0000)
------------------------------------------------------------------
H0: log_iwi does not Granger-cause log_dig.
H1: log_iwi does Granger-cause log_dig for at least one panel (prov).

.
```

Appendix 5: VIF for 8 independent Variables

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
       asset |     38.06    0.026271
         edu |     21.38    0.046773
         dig |     17.88    0.055944
         urb |     14.45    0.069208
         ele |     14.14    0.070714
         hea |     10.51    0.095118
        hhse |      3.92    0.254931
        hseq |      3.62    0.276299
-------------+----------------------
    Mean VIF |     15.50
```

Appendix 6: VIF for 6 Logged Independent Variables

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
     log_dig |      6.18    0.161851
     log_hea |      5.08    0.196993
     log_ele |      4.46    0.224296
     log_urb |      3.61    0.276751
    log_hhse |      2.71    0.369209
    log_hseq |      1.47    0.678942
-------------+----------------------
    Mean VIF |      3.92
```

Appendix 7: Heteroscedasticity Tests

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of log_iwi

         chi2(1)      =     4.32
         Prob > chi2  =   0.0377
```

Appendix 8: Panel OLS

```
. regress  log_iwi log_dig log_ele log_hea log_hhse log_hseq log_urb

      Source |       SS       df       MS              Number of obs =     150
-------------+------------------------------           F(  6,   143) =  366.93
       Model |  2.78065615     6  .463442692            Prob > F      =  0.0000
    Residual |  .180610907   143  .001263013            R-squared     =  0.9390
-------------+------------------------------           Adj R-squared =  0.9364
       Total |  2.96126706   149  .019874276            Root MSE      =  .03554

------------------------------------------------------------------------------
     log_iwi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     log_dig |   .1691125   .0216503     7.81   0.000     .1263165    .2119085
     log_ele |   .0971305   .0224884     4.32   0.000      .052678    .1415831
     log_hea |  -.2205384   .0778128    -2.83   0.005    -.3743504   -.0667264
    log_hhse |  -.7323683   .1464645    -5.00   0.000    -1.021883   -.4428531
    log_hseq |  -.1012812   .0205189    -4.94   0.000    -.1418408   -.0607215
     log_urb |   .1773102   .0134336    13.20   0.000     .1507561    .2038642
       _cons |   1.530801   .1420632    10.78   0.000     1.249986    1.811616
------------------------------------------------------------------------------
```

Appendix 9: Fixed Effects Model

```
. xtreg log_iwi log_dig log_ele log_hea log_hhse log_hseq log_urb, fe

Fixed-effects (within) regression               Number of obs      =       150
Group variable: prov                            Number of groups   =        10

R-sq:  within  = 0.8345                         Obs per group: min =        15
       between = 0.8013                                        avg =      15.0
       overall = 0.7378                                        max =        15

                                                F(6,134)           =    112.62
corr(u_i, Xb)  = 0.5247                         Prob > F           =    0.0000

------------------------------------------------------------------------------
     log_iwi |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     log_dig |   .1429925   .0173985     8.22   0.000     .1085813    .1774037
     log_ele |   .1317164   .0180929     7.28   0.000     .0959317     .167501
     log_hea |   .1058015   .0757024     1.40   0.165    -.0439247    .2555276
    log_hhse |   .6474319   .1833354     3.53   0.001     .2848264    1.010037
    log_hseq |  -.0930099   .0701833    -1.33   0.187    -.2318204    .0458005
     log_urb |   .0533086   .0380833     1.40   0.164    -.0220135    .1286308
       _cons |   .7315807   .1648218     4.44   0.000     .4055918     1.05757
-------------+----------------------------------------------------------------
     sigma_u |  .08435241
     sigma_e |  .02447661
         rho |   .9223398   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(9, 134) =    18.61                 Prob > F = 0.0000
```

Appendix 10: Random Effects Model

```
. xtreg log_iwi log_dig log_ele log_hea log_hhse log_hseq log_urb, re

Random-effects GLS regression                   Number of obs      =       150
Group variable: prov                            Number of groups   =        10

R-sq:  within  = 0.8114                         Obs per group: min =        15
       between = 0.9460                                        avg =      15.0
       overall = 0.9222                                        max =        15

                                                Wald chi2(6)       =    851.33
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
     log_iwi |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     log_dig |   .1634375   .0185415     8.81   0.000     .1270969    .1997782
     log_ele |   .1121076   .0193355     5.80   0.000     .0742108    .1500044
     log_hea |  -.0700031   .0724716    -0.97   0.334    -.2120449    .0720386
    log_hhse |   .1220922   .1789834     0.68   0.495    -.2287088    .4728933
    log_hseq |  -.0551905   .0369504    -1.49   0.135     -.127612     .017231
     log_urb |   .1849262   .0181835    10.17   0.000     .1492871    .2205652
       _cons |   .8677465   .1622216     5.35   0.000      .549798    1.185695
-------------+----------------------------------------------------------------
     sigma_u |  .01820846
     sigma_e |  .02447661
         rho |  .35625333   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Appendix 11a: Haussmann test (OLS and FEM)

```
. hausman fe ols

                 ---- Coefficients ----
                |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
                |       fe          ols          Difference          S.E.
----------------+----------------------------------------------------------------
     log_dig    |    .1429925     .1691125        -.02612              .
     log_ele    |    .1317164     .0971305       .0345859              .
     log_hea    |    .1058015    -.2205384       .3263398              .
    log_hhse    |    .6474319    -.7323683         1.3798       .1102725
    log_hseq    |   -.0930099    -.1012812       .0082712       .0671169
     log_urb    |    .0533086     .1773102      -.1240015       .0356353
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from regress

    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      149.64
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)
```

Appendix 11b: Haussmann test (REM and FEM)

```
. hausman re fe

                 ---- Coefficients ----
              |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
              |       re           fe          Difference          S.E.
--------------+----------------------------------------------------------------
     log_dig  |    .1634375     .1429925         .020445        .0064094
     log_ele  |    .1121076     .1317164       -.0196087        .0068196
     log_hea  |   -.0700031     .1058015       -.1758046               .
    log_hhse  |    .1220922     .6474319       -.5253397               .
    log_hseq  |   -.0551905    -.0930099        .0378195               .
     log_urb  |    .1849262     .0533086        .1316175               .
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      305.43
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)
```

Appendix 12: Difference GMM (Arellano and Bond Estimator)

```
. xtabond log_iwi log_dig log_ele log_hea log_hhse log_hseq log_urb

Arellano-Bond dynamic panel-data estimation  Number of obs          =       130
Group variable: prov                         Number of groups       =        10
Time variable: years
                                             Obs per group:    min =        13
                                                               avg =        13
                                                               max =        13

Number of instruments =     92               Wald chi2(7)           =   1354.73
                                             Prob > chi2            =    0.0000
One-step results
```

log_iwi	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
log_iwi						
L1.	.5520071	.0853257	6.47	0.000	.3847718	.7192424
log_dig	.1124393	.0344263	3.27	0.001	.0449651	.1799135
log_ele	.0254568	.0165924	1.53	0.125	-.0070636	.0579773
log_hea	-.1020901	.0847693	-1.20	0.228	-.2682349	.0640547
log_hhse	.1846044	.1497659	1.23	0.218	-.1089313	.4781401
log_hseq	.0257437	.066978	0.38	0.701	-.1055308	.1570181
log_urb	.0225838	.0363501	0.62	0.534	-.0486611	.0938287
_cons	.2796183	.141742	1.97	0.049	.001809	.5574276

```
Instruments for differenced equation
        GMM-type: L(2/.).log_iwi
        Standard: D.log_dig D.log_ele D.log_hea D.log_hhse D.log_hseq D.log_urb
Instruments for level equation
        Standard: _cons
```

Appendix 13: Step One System GMM (Arellano and Bover/Blundel and Bond estimators)

```
. xtdpdsys log_iwi log_dig log_ele log_hea log_hhse log_hseq log_urb, noconstant lags(1) artests(2)

System dynamic panel-data estimation         Number of obs         =       140
Group variable: prov                         Number of groups      =        10
Time variable: years
                                             Obs per group:    min =        14
                                                               avg =        14
                                                               max =        14

Number of instruments =    104               Wald chi2(7)          = 698098.08
                                             Prob > chi2           =    0.0000
One-step results
```

log_iwi	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
log_iwi						
L1.	.596824	.0766291	7.79	0.000	.4466336	.7470143
log_dig	.1317472	.0305182	4.32	0.000	.0719325	.1915618
log_ele	.0326704	.0124315	2.63	0.009	.0083052	.0570357
log_hea	-.1285252	.0677119	-1.90	0.058	-.261238	.0041876
log_hhse	.4002451	.0828149	4.83	0.000	.2379308	.5625595
log_hseq	.030486	.0345848	0.88	0.378	-.0372989	.0982709
log_urb	.0084592	.023514	0.36	0.719	-.0376274	.0545458

```
Instruments for differenced equation
        GMM-type: L(2/.).log_iwi
        Standard: D.log_dig D.log_ele D.log_hea D.log_hhse D.log_hseq D.log_urb
Instruments for level equation
        GMM-type: LD.log_iwi
```

Appendix 14: Step 2: System GMM (Arellano and Bover/Blundel and Bond estimators)

```
. xtdpdsys log_iwi log_dig log_ele log_hea log_hhse log_hseq log_urb, noconstant lags(2) artests(2)

System dynamic panel-data estimation          Number of obs          =        130
Group variable: prov                          Number of groups       =         10
Time variable: years
                                              Obs per group:     min =         13
                                                                 avg =         13
                                                                 max =         13

Number of instruments =    103                Wald chi2(8)           = 694593.15
                                              Prob > chi2            =    0.0000
One-step results
------------------------------------------------------------------------------
     log_iwi |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     log_iwi |
         L1. |   .5232833   .1709291     3.06   0.002     .1882685    .8582982
         L2. |  -.2502662   .1435087    -1.74   0.081    -.5315381    .0310057
             |
     log_dig |   .3030609   .0454513     6.67   0.000      .213978    .3921439
     log_ele |   .0683861   .0169142     4.04   0.000     .0352349    .1015373
     log_hea |  -.3856177   .0863629    -4.47   0.000    -.5548859   -.2163496
    log_hhse |   .5175313   .0890117     5.81   0.000     .3430715    .6919911
    log_hseq |  -.0085777   .0378017    -0.23   0.820    -.0826676    .0655122
     log_urb |   .0506726   .0252844     2.00   0.045      .001116    .1002292
------------------------------------------------------------------------------
Instruments for differenced equation
        GMM-type: L(2/.).log_iwi
        Standard: D.log_dig D.log_ele D.log_hea D.log_hhse D.log_hseq D.log_urb
Instruments for level equation
        GMM-type: LD.log_iwi
```

Appendix 15: Sargan Test and Arellano and Bond (1991) Tests

```
. xtabond2

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: prov                            Number of obs      =       150
Time variable : years                           Number of groups   =        10
Number of instruments = 106                     Obs per group: min =        15
Wald chi2(6)  =  1.31e+06                                      avg =     15.00
Prob > chi2   =     0.000                                      max =        15
------------------------------------------------------------------------------
     log_iwi |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     log_dig |   .1639788   .0120558    13.60   0.000     .1403498    .1876079
     log_ele |   .0839636   .0114125     7.36   0.000     .0615954    .1063317
     log_hea |  -.1868632   .0422932    -4.42   0.000    -.2697564     -.10397
    log_hhse |   -.715619   .0923549    -7.75   0.000    -.8966312   -.5346068
    log_hseq |  -.1300879   .0111289   -11.69   0.000    -.1519001   -.1082756
     log_urb |   .1942447   .0071391    27.21   0.000     .1802524    .208237
       _cons |    1.56218   .0886951    17.61   0.000     1.388341    1.736019
------------------------------------------------------------------------------
Instruments for first differences equation
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/14).log_iwi
Instruments for levels equation
  Standard
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.log_iwi
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =   1.23  Pr > z =  0.220
Arellano-Bond test for AR(2) in first differences: z =  -0.01  Pr > z =  0.996
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(99)    = 474.97  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(86)    = 233.18  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(13)    = 241.79  Prob > chi2 =  0.000
```

Appendix 16: Ethical Clearance

NWU®
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YUNIBESITI YA BOKONE-BOPHIRIMA

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Fax: 018 299-4910
Web: http://www.nwu.ac.za

Senate Committee for Research Ethics
Tel: 018 299-484
Feziwe.Mseleni@nwu.ac.za

28 August 2023

ETHICS APPROVAL LETTER OF STUDY

Based on approval by the **Economic and Management Sciences Research Ethics Committee (EMS-REC)** on, 25/08/2023 the Economic and Management Sciences Research Ethics Committee hereby **approves** your study as indicated below. This implies that the North-West University Senate Committee for Research Ethics (NWU-REC) grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: Analysing the relationship between digitalisation and poverty dimension in Zimbabwe

Study Leader/Supervisor (Principal Investigator)/Researcher): Prof O David

Student: TO Nyamutswa (37435469)

N	W	U	-	0	1	8	5	3	-	2	3	-	A	4
Institution				Study Number						Year			Status	

Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Application Type:
Commencement date: 28/08/2023 **Risk:** **Minimal**
Expiry date: 28/08/2024
Approval of the study is initially provided for a year, after which continuation of the study is dependent on receipt and review of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation.

Special in process conditions of the research for approval (if applicable):

•

General conditions:

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, the following general terms and conditions will apply:

- *The study leader/supervisor (principle investigator)/researcher must report in the prescribed format to the EMS-REC:*
  - *annually (or as otherwise requested) on the monitoring of the study, whereby a letter of continuation will be provided, and upon completion of the study; and*
  - *without any delay in case of any adverse event or incident (or any matter that interrupts sound ethical principles) during the course of the study.*
- *The approval applies strictly to the proposal as stipulated in the application form. Should any amendments to the proposal be deemed necessary during the course of the study, the study leader/researcher must apply for approval of these amendments at the EMS-REC, prior to implementation. Should there be any deviations from the study proposal without the necessary approval of such amendments, the ethics approval is immediately and automatically forfeited.*
- *Annually a number of studies may be randomly selected for an external audit.*
- *The date of approval indicates the first date that the study may be started.*

n the interest of ethical responsibility, the NWU-SCRE and EMS-REC reserves the right to:

1

- *request access to any information or data at any time during the course or after completion of the study;*
- *to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process;*
- *withdraw or postpone approval if:*
  - *any unethical principles or practices of the study are revealed or suspected;*
  - *it becomes apparent that any relevant information was withheld from the EMS-REC or that information has been false or misrepresented;*
  - *submission of the annual (or otherwise stipulated) monitoring report, the required amendments, or reporting of adverse events or incidents was not done in a timely manner and accurately; and / or*
  - *new institutional rules, national legislation or international conventions deem it necessary.*

The EMS-REC would like to remain at your service as scientist and researcher, and wishes you well with your study. Please do not hesitate to contact the EMS-REC or the NWU-SCRE for any further enquiries or requests for assistance.

Yours sincerely,

Mark Rathbone

Digitally signed by Mark Rathbone
DN: cn=Mark Rathbone, o=North-West University, ou=Business management, email=mark.rathbone@nwu.ac.za, c=ZA
Date: 2023.08.30 09:41:22 +02'00'

Prof Mark Rathbone
Chairperson: NWU Economic and Management Sciences Research Ethics Committee

Appendix 17: Registration Of Title

NWU®
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Tel: (018) 299-1111/2222
Web: http://www.nwu.ac.za

Higher Degree Administration

Tel: 0169103033
Email: 22989064@nwu.ac.za
Enquiries: MISS J WILSON

17 October 2023

Dear MR NYAMUTSWA
University number: 37435469

REGISTRATION OF TITLE

At the recent meeting of a relevant committee meeting of the NWU Faculty of Economic and Management Sciences your title was approved as follows:

Analysing the relationship between digitalization and poverty dimension in Zimbabwe

The above-mentioned title may under **no circumstances** be changed without consulting your supervisor and obtaining the approval from the relevant committee in the mentioned faculty, in regard of which this office must be furnished with the latest approved title.

In the instance that you wish to submit for examination, please inform your supervisor/promoter accordingly. *Also ensure absolute adherence to the prescripts of A Rule 4.10 for the submission of a Master's study and of A Rule 5.10 for the sumbission of Doctoral thesis.*

Upon approval of your supervisor/promoter, please ensure that the Notice of Submission form is submitted THREE months in advance to this office.

Note that the Notice of Submission form is available on the NWU DIY portal.

For ease of reference, use the following resources:

- General Academic Rules (A-reëls):
- Manual for Higher Degree Studies:
- Policy on academic integrity:
- Forms that support the study guidance process:

We wish you a pleasant and successful period of study.

Kind regards

Registrar

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YUNIBESITI YA BOKONE-BOPHIRIMA
2023/10/17

Reference number: 7.1.11.1.2