Closing the digital divide in Africa: The role of mobile telecommunications and universal access and service policies

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Closing the digital divide in Africa: The role of mobile telecommunications and universal access and service policies

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Abstract

The liberalisation of telecommunications market in Africa, which was propelled by a sector-wide reform at the turn of the millennium, has led to an unprecedented level of mobile penetration. Despite the progress that has been achieved, evidence also indicates that the market has failed to address the widespread provision of telecommunications, with pockets of digital divides of uneven mobile coverage existing across the continent albeit to varying degrees. The efforts of governments in Africa to close this digital divide have given rise to a range of universal access and service (UAS) policies.

The thesis investigates the interplay between market liberalisation, market failure and UAS to understand *why* digital divide persists across Africa and *how* this problem could be mitigated. Adopting a qualitative multi-case study approach, the thesis finds that a set of complex issues interact to impede the widespread provision of telecommunications services. Drawing on the public interest and economic efficiency perspectives of market failure, regulatory capacity and transaction costs emerged as the two key underpinning issues on which a model for closing the digital divide in Africa was then developed.

We find that since regulators across Africa are largely faced with limited human and financial resources, they tend to lack the capacity to formulate robust UAS policies, implement and effectively monitor UAS activities. On the other hand, since mobile network operators (MNO) are profit driven, the transaction costs of network deployment and maintenance is critical in shaping investment decision so much so that they tend to concentrate on commercially viable areas.

The model argues that UAS policy should be formulated in a manner that empowers regulatory authorities with adequate resources to promote widespread access to telecommunication services and, at the same time, facilitate economic efficiency in order to make it feasible for MNO to economically provide infrastructure and services.

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List of Abbreviations

2G: 2nd Generation mobile technology

3G: 3rd Generation mobile technology

4G: 4th Generation mobile technology

ANC: African National Congress

AISI: Africa Information Society Initiative

APAUS: L'Agence de Promotion de l'Accès Universel aux Services

ARPT: Algeria Regulatory Authority for Post and Telecommunications

ARPU: Average revenue per user

AU: African Union

BOCRA: Botswana Communications Regulatory Authority

BSC: Base Station Controller

BTS: Base Transceiver Stations

CA: Communications Authority of Kenya

CAPEX: Capital expenditure

CAQDAS: Computer Assisted Qualitative Data Analysis Software

CBN: Central Bank of Nigeria

CDMA: Code division multiple access

CEO: Chief executive officer

CGSUT: Universal Telecommunications Services Management Committee

COMESA: Common Market for Eastern and Southern Africa

CSR: Corporate social responsibility

CTO: Commonwealth Telecommunications Organisation

DRC: the Democratic Republic of the Congo

EASSy: East African Submarine Cable System

ECOWAS: Economic Community of West African States

EU: European Union

FCC: Federal Communications Commission

FDI: Foreign direct investment

FSUT: Universal Telecommunication Service Fund

GDP: Gross domestic product

GDPR: General Data Protection Regulation

GI: Green-field investment

GIFEC: Ghana Investment Fund for Electronic Communications

GIS: Geographic information system

GMT: Greenwich Mean Time

GSM: Global System for Mobile communication

GSMA: Global System for Mobile communication Association

ICASA: Independent Communications Authority of South Africa

ICO: Information Commissioner's Office

ICT: Information and communication technology

IP: Internet Protocol

ISP: Internet service provider

ITS: International Telecommunications Society

ITU: International Telecommunication Union

LCE: Local community enterprise

LLU: Local Loop Unbundling

LTE: Long-Term Evolution

JV: Joint-venture

M&A: Mergers and acquisitions

MACRA: Malawi Communications Regulatory Authority

MHz: Megahertz

MNE: Multinational entities

MNO: Mobile network operators

MTR: Mobile termination rate

MVNO: Mobile Virtual Network Operator

NCA: National Communications Authority

NCC: Nigerian Communications Commission

NFV: Network Function Virtualisation

NITEL: Nigeria Telecommunications Limited

NGO: Non-governmental organisations

NREN: National Research and Education Networks

OECD: Organisation for Economic Co-operation and Development

Ofcom: Office of Communications

OPEX: Operating expenditure

OTT: Over-the-top players

PERG: Programme d'Electrification Rurale Globale

PRASA: Passenger Rail Agency of South Africa

QoS: Quality of service

RCDF: Rural Communications Development Fund

ROI: Return on investment

RQ1: Research question 1

RQ2: Research question 2

RURA: Rwanda Utilities Regulatory Authority

SADC: Southern African Development Community

SIM: Subscriber identity module

TEAMS: The East African Marine System

TRASA: Telecommunications Regulatory Association of Southern Africa

TVWS: Television White Space

UA: Universal access

UAE: United Arab Emirates

UAS: Universal access and services

UCC: Uganda Communications Commission

UMTS: Universal mobile telecommunications system

UNECA: United Nations Economic Commission for Africa

UK: United Kingdom

US: Universal service

USA: United States of America

USAASA: Universal Service and Access Agency of South Africa

USAF: Universal Service and Access Fund

USF: Universal service funds

UTS: Universal Telecoms Service

VAT: value-added tax

VoIP: Voice over Internet Protocol

Wi-Fi-: Wireless fidelity

WiMAX: World Wide Interoperability for Microwave Access

WLAN: Wireless Local Area Network

WOAN: Wireless Open Access Network

WRC: World Radiocommunication Conferences

WTO: World Trade Organisation

ZICTA: Zambia Information and Communications Technology Authority

Dedication

…to God, the Almighty without Whom I am nothing.

…and to my wife and daughter, Elohor and Aisosa – thank you for your love, support and tolerating all my late nights at the university!

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Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is entirely my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others. Since interviews were conducted as part of this study, ethical clearance for the data and research presented in this thesis has approved. The approval was sought and granted by the Faculty Ethics Committee on July 03, 2015.

Part of the findings of this thesis has been published in the following paper:

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Another has been presented at the following conference:

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Chapter 1: Introduction

1.1 Background to the thesis

Before the turn of the millennium, the telecommunications sector across Africa was run by state monopolies who mainly provided fixed services (Berg & Hamilton, 2002; Chavula, 2013; ITU, 2009). The performance of these state monopolies was unsatisfactory, as evident in the low penetration of fixed-line due in part to the lack of investment and technical capacity in the industry (Ibrahim, 2012; ITU, 1999; Minges, 1998; Williams & Kwofie, 2014). For example, the highest penetration for continental Africa prior to 2000/2001, was 1.74 fixed lines per 100 inhabitants while other regions such as East Asia had 8.23 and Latin America and the Caribbean had 13.21 fixed lines for the same period (Gebreab 2002; Minges 1998). The situation was worse in Sub-Saharan Africa which had 0.48 fixed lines penetration per 100 persons (Minges, 1998). Access to mobile lines was also not different as only 4%, around 30 million of over 760 million people in Africa, had access to mobile lines before 2000/2001 (GSMA, 2011; ITU, 1999; UN, 1998). Overall, the levels of telecommunications coverage provided were largely concentrated as state monopolies barely deployed network outside their capital cities, which also had long waiting lists for fixed connection (Gebreab, 2002). For example, the waiting list in Sub-Saharan Africa at the end of 1995 stood at about 1.5 million households, an equivalent of a quarter of the 6 million fixed lines in operation for the same period (IFC, 2016).

This indicated that a considerable number of people were unserved, which led to growing pressure on governments to expand telecommunications coverage (Gebreab, 2002; Hudson, 2006; Williams & Kwofie, 2014). There was thus a compelling case to extend telecommunications coverage to ***unserved*** (areas with no telecommunication infrastructure [Hudson, 2010]) and ***underserved*** (areas with unreliable telecommunication infrastructure or in some cases, where infrastructure exit but there is low levels of service adoption due to the unaffordability of tariffs and mobile devices to a large number residents [Hudson, 2010]) locations, hereafter called ***disadvantaged areas***. The definition of underserved areas by Hudson (2010) suggests that the expansion of telecommunications goes beyond promoting a first-level issue related to physical access to infrastructure to second-level issues connected to stimulating adoption and usage, which is partly underlined by unaffordability (Campos-Castillo, 2014; Hargittai, 2002; van Deursen & Helsper, 2015). Issues

connected to unaffordability indicate that if people cannot afford mobile devices and/or tariff plans even when there is a network, a complementary segment of the market could be said to be missing, which could then lead to market failure (see Sections 3.2.1 and 5.3.4). This indicates that the supply of the network and the demand for services are complementary - as one cannot succeed without the other otherwise it results in a missing market[1] (Beare & Newby, 2005; Dollery, 2001). Issues relating to service demand can be better explained from a demand-side perspective that explores barriers such as unaffordability of mobile devices (including smartphones), low-incomes and a lack of digital education, which reflects in the inability of consumers to use mobile devices and optimally engage with the Internet (Gillwald, 2017; Gillwald, Mothobi, & Rademan, 2018).

Evidence of this is highlighted in Chair and De Lannoy (2018), which drew from the 2017 RIA[2] After Access Survey (a study that explored beyond access issues in countries like Ghana, Kenya, Mozambique, Nigeria, Tanzania and South Africa). Chair and De Lannoy (2018) highlighted that the unaffordability of mobile devices, particularly mobile phones, restricts access to mobile telecommunications for over 60% of 15-25 years in Nigeria and over 70% of the same age bracket in Tanzania (Chair & De Lannoy, 2018). Meanwhile, over 13% of this age bracket in Nigeria and 35% in Tanzania say they do not own a mobile phone, not necessarily because of unaffordability but due to the lack of knowledge on how to use it, highlighting the issue of a lack of digital education (Chair & De Lannoy, 2018).

The implications of these findings are far-reaching given that such an age bracket constitutes more than half of the over one billion people living across Africa (World Bank, 2017). That said, these demand-side issues are largely not covered in this study given that the main focus here is to explore the first-level digital divide issue of physical access to telecommunications infrastructure and not second-level issues related to skills and usage or a third-level that explores tangible outcomes in terms of the type of people most likely to benefit from digital inclusion (Campos-Castillo, 2015; Hagittai, 2002; van Deursen & Helsper, 2015). Hence it is useful to

[1] See Section 3.2.1 for the definition of a missing market.

[2] Research ICT Africa – a public interest ICT policy and regulation think tank based in Cape Town, South Africa (Research ICT Africa, 2017).

acknowledge upfront that though demand-side barriers exit, this is a very supply-side focused study. However, since both the supply-and-demand-sides of the divide are equally important and complementary (Mohamed Nour 2017), the demand-side issues could be further explored in a separate complementary study.

Having made the above clarification, this study proceeds with the understanding that the investigation of telecommunications is compounded not just by the fast and frequent evolution of information and communication technology (ICT) but also changing market conditions (Batura, 2016, pp. 12), it is useful at this point to state what telecommunication services mean in this study. Telecommunication services in this study refer to mobile telecommunications deployed to end-users, including voice and data services. Although state monopolies focused more on the deployment of fixed-line, one of the justifications for focusing on mobile telecommunications in this study is that market liberalisation resulted in a switch to mobile, which is more cost-effective to deploy compared to fixed network as examined in Section 2.2. Mobile telephony has thus facilitated an unprecedented level of *access*[3] to telecommunications for millions across Africa (Esselaar, Gillwald, & Stork, 2007; ITU, 2016). Unlike in advanced economies in North America and Europe[4] where investment was first made in fixed network before moving to mobile network, mobile telephony has effectively helped Africa to leapfrog many years of government neglect and plug the gaps in fixed network (Aker & Mbiti, 2010; Haftu, 2018; Manson, 2013). Additionally, mobile telephony is driving the convergence of telecommunications by enabling the combination of multiple services like voice, data and images over a single network (Cramer, 2015; Hudson, 2006). Consequently, end-users can now access a plethora of ICT services on their mobile phones, which is fast becoming a critical socio-economic enabler across Africa (Collett, 2016; Jagun, Heeks, & Whalley, 2008).

Having clarified what telecommunications mean in this study, its expansion requires a large investment in infrastructure (Hudson, 2010; ITU, 2015; World Bank, 2018a). Since this was generally lacking across Africa, albeit in varying proportions between countries and regions, governments turned to the World Bank and its

[3] See Section 3.3.1 for the definition of access in the context of this study.

[4] This excludes Eastern Europe, which moved like Africa from a limited fixed infrastructure to extensive mobile networks (Armstrong & Vickers, 1996; Welfens, 1995).

associated bodies for financial and technical support (Haftu, 2018; Irwin & Brook, 2003; Sutherland, 2014). Prime among the conditions for obtaining such support was the need to introduce reforms, including the 1997 World Trade Organisation (WTO) Basic Telecommunications Agreement and the General Agreement on Trade in Services (Ojo, 2016; WTO, 1997). The negotiations of the aforementioned reforms were concluded on February 15, 1997, with the signature of 69 countries, including Ghana, South Africa and Tunisia (WTO, 1997). One of the central commitments made at this meeting was the need to liberalise trade in general and minimise government involvement in the telecommunications sector in order to make the industry more effective and efficient, attract more investment and facilitate growth (Sutherland, 2014; WTO, 1997; Wanjiku 2014). In the words of the Director-General of WTO at that time, Mr. Renato Ruggiero, "… *the telecommunications deal will contribute to lower costs for consumers, and the price reductions will be very significant… Information and knowledge, after all, are the raw material of growth and development in our globalised world*" (WTO, 1997, p.1). This commitment did not only cover cross-country supply of telecommunications infrastructure but also services such as fixed and mobile telecommunications (IFC, 2016; WTO, 1997).

The implementation of these reforms was initiated through the Africa Information Society Initiative (AISI), a meeting sponsored by the United Nations Economic Commission for Africa (UNECA, 1996 & 2003). One of the main visions proposed by AISI was the need to encourage and build a sustainable digital society for Africa so that *"… every man and woman, school child, village, government office and business can access information and knowledge resources through computers and telecommunications"* (UNECA, 1996 & 2003). With these reforms came the liberalisation of the telecommunications industry across Africa, for example, the mid-1990s in South Africa and 2001 in Nigeria (Gillwald, Moyo, & Stork, 2012; Onyeajuwa, 2017).

The sector liberalisation has now created a complex and dynamic mobile telecommunications market populated with a mix of African and international mobile network operators (MNO) whose activities have not only contributed to an unprecedented level of investments but also the spread of mobile telephony and diffusion across Africa. For example, in contrast to the 4% mobile penetration prior to liberalisation, the continent now averages over 50% (GSMA, 2017b). The introduction

of liberalisation and competition have thus changed the telecommunications landscape and, by extension, the way people communicate. However, the current situation also provides evidence that reflects the fact that the vision of AISI in providing telecommunications for all across Africa is far from being realised nearly two decades after the introduction of liberalisation (GSMA, 2016b; ITU, 2016). Studies (for example, Foster & Briceno-Garmendia, 2010; Manimohan, 2013; GSMA, 2016a) have found that while market liberalisation has drastically reduced the gaps in telecommunications coverage in densely populated urban areas, the same cannot be said of under and unserved rural and suburban locations (hereafter called disadvantaged areas). This suggests that whilst the market has dramatically reduced coverage gaps in densely populated areas, it has failed to record the same level of success in suburban and rural areas where digital divide[5] remains a challenge (UNCTAD, 2017; World Bank, 2018b).

The effort of governments in Africa to address this market failure[6] of inequitable distribution of mobile coverage resulted to universal access and services (UAS) – a policy targeted at ensuring no one is excluded from universal access to telecommunications (ITU, 2013b; Oestmann & Dymond, 2008; Souter, 2016). Over 30 countries in Africa have established universal service funds (USF) as their UAS strategy of bridging coverage gaps (Arakpogun, Wanjiru, & Whalley, 2017). However, achieving widespread coverage has also proven to be difficult, as an estimated 500 million people remain unconnected to mobile telecommunications across Africa (Collins, 2015; GSMA, 2016b; 2017b; Manson, 2013).

1.2 Thesis objectives and motivation

The concluding part of Section 1.1 points to a research gap that both the market and UAS policy have failed to closed the digital divide in Africa, prompting two critical questions:

RQ1 - *with the introduction of market liberalisation and the establishment of UAS strategy like USF, why does the digital divide of uneven mobile coverage persists areas across Africa?*

RQ2 - *how can the digital divide of uneven mobile coverage be mitigated?*

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[5] See Section 2.4 for the definition of digital divide

[6] See Section 3.2 for the definition of market failure.

Therefore, the aim of this thesis is to investigate and understand why UAS strategy like USF has failed to address the digital divide of uneven mobile coverage and develop a model that offers insights on how to mitigate identified challenges. The thesis will achieve this through a conceptual framework predicated upon the interaction of market liberalisation, market failure and UAS policy as illustrated in Figure 6 in Section 3.5. The investigation of market liberalisation is to highlight that competition, driven by the spread of foreign direct investment (FDI), is a key driver of the transformation of the sector. While such transformation has led to an increase in mobile penetration and adoption from 4% in 1999 to around 50% in 2016, over 500 million people still lack access to mobile telecommunications (Collins, 2015; GSMA, 2016b; Manson, 2013). The effort of governments in Africa to close this digital divide of uneven mobile coverage led to the issue of UAS policy (ITU, 2013b), which can be examined through the lens of market failure (Stiglitz, 2010; Trubnikov, 2017).

While the details of these issues will become clearer as the thesis progresses, the argument above underlines why this thesis has chosen to address the research questions raised above by critically investigating the interplay between market liberalisation, market failure and UAS policy in Africa. Since the current study aims to explore and understand a social problem centred on mobile coverage, a multi-case study approach that draws on the insights of various relevant stakeholders within the sector is adopted (Creswell, 2009; Hughes & Sharrock, 1997). This will enable this thesis to offer practical solutions that will contribute to closing the digital divide of uneven mobile coverage in Africa.

The motivation for such contribution derives from two rationales: **the strategic importance of the telecommunications sector** (ITU, 2016; UNCTAD, 2008; World Economic Forum, 2014) and **the general dearth of research on telecommunications in Africa** (Dike & Rose, 2018; Jagun, Heeks, & Whalley, 2008). The growing influence of the evolving digital economy is noticeable across the globe. This can be illustrated by its impact on international trade in terms of the cross-boundary movement of ICT equipment and services that increased by 40% from 2010 to 2015, amounting to over $400 billion in real terms and 6.5% of global GDP (UNCTAD, 2017). In the same vein, the strategic importance of the telecommunications sector reflects in various spheres in Africa. For example, compared to a $100 million generated in the continent in 1995, mobile revenue increased to $40 billion at the end

of 2015, 85% of which comes from voice and 25% form data service (IFC, 2016). In terms of GDP, the ecosystem of mobile telecommunications contributed about 6.7% to continental Africa at the end of 2015, an equivalent of $153 billion, which is projected to increase to 7.6%, around $214 billion by 2020 (GSMA, 2016a). As such, government across Africa are becoming heavily dependent on revenues from duties and taxes on telecommunication services to fund national budgets (Curwen & Whalley, 2018; Hudson, 2006).

Apart from the economic gains, many people across the continent are increasingly dependent on mobile telephony, not just for their basic communication but also for their daily activities (Donner, 2004; Molony, 2006). This is evident in the benefits people derive from the ICT ecosystem, which cut across sectors like education, banking, health, jobs and politics (ITU, 2017d; Reed, 2016). Take banking, for instance, it has long been established that the majority of Africans are unbanked, that is, those who do not have access to traditional financial services, which is estimated at two-thirds of the over 1 billion people in Africa (World Bank, 2015; 2017). The introduction of mobile money platforms like M-PESA in March 2007 in Kenya has proven to be a 'game changer' (Banerjee, 2017; Telecompaper, 2017c). As at the end of 2016, M-PESA Kenya, operated by Safaricom, had over 29 million active users and 287,000 mobile money agents transacting over $30 billion - a figure that surpasses the country's 2017/2018 total budget of $25 billion (Financial Technology, 2017; KPMG, 2017). Mobile money is also becoming a useful tool for Zimbabweans to navigate the challenge of physical cash shortage in the country with 485 million transactions accounting for $11 billion worth of electronic money transfer in 2017 (Kachembere, 2017; Karombo, 2017). Mobile money is now active in over 10 countries including Ghana, Tanzania and Uganda (Abdella, 2017; Gilbert, 2017). In light of the strategic importance of the sector and the vital role of mobile telephony in terms of its enabling capacity and the opportunities it creates, closing the digital divide in Africa is critical for both economic growth and sustainable development (ITU, 2017a).

Despite the strategic importance of telecommunications, there is a general dearth of studies looking into this sector in Africa compared to advanced countries (Donner, 2004; Haftu, 2018; Jagun, Heeks, & Whalley, 2008; Symeou & Pollitt, 2007). Whilst continental Africa introduced liberalisation and competition relatively

later than other parts of the world, the continent has embraced liberalisation on one hand and the evolution of mobile technologies on the other hand, attracting over $200 billion worth of FDI between 1999 and 2015 (GSMA, 2016a; van-Huyssteen, 2012). Consequently, a complex and dynamic telecommunications market has emerged. In spite of this, very limited number of studies (for example, Aker & Mbiti, 2010; Chavula, 2013; Curwen & Whalley, 2014) have focused on telecommunications in Africa. This thesis is motivated by the desire to generate insights into the sector and extend the literature on telecommunications and UAS in Africa with the aim of contributing to bridging the knowledge gaps between the continent and other parts of the world.

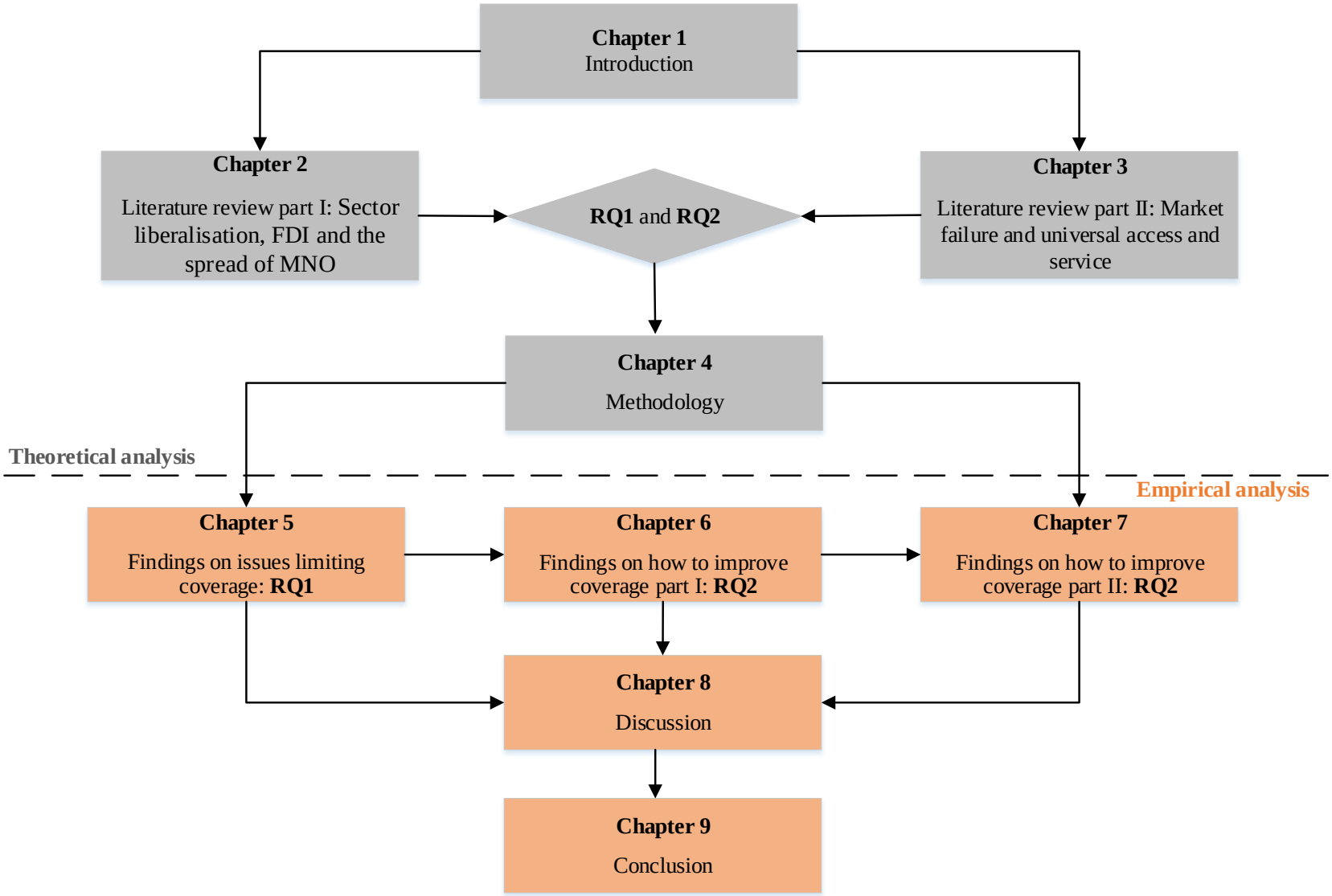
1. 3 Structure of the thesis

The remaining part of the thesis is divided into eight chapters. Figure 1 depicts the ordering and linkages between the chapters. The literature review for this study is split into Chapters 2 and 3. Chapter 2 examines the sector liberalisation, FDI and the spread of MNO across Africa. This is borne out of the desire to investigate the development and the impact of competition on the sector. The evidence that emerged from this process was used to compare and contrast the state monopolies regime and the market dominated era that followed from the introduction of liberalisation. Chapter 2 finds that although market liberalisation has improved mobile penetration and adoption from 4% in 1999 to a continental average of 50% between 2016 and 2017, the digital divide of uneven mobile coverage persists across Africa. A clear indication that the market has failed to address the telecommunication needs of the wider society.

Chapter 3 thus shifts the focus of the study to market failure and the effort of governments in Africa to address the imbalance of mobile coverage through the intervention of UAS policy. It begins by exploring the concept of market failure in order to provide a theoretical understanding as to why markets fail and the various instruments a government can employ to mitigate market failure. This was necessary to provide a theoretical guidance for the analysis of UAS policy and USF as a popular instrument for closing digital divide, which over 30 countries in Africa have adopted. To avoid ambiguity and ensure consistency, the chapter defines key terms such as market failure and transaction costs in the context of this study. The chapter concludes with a conceptual framework in Figure 6 (Section 3.5) that is predicated on three key

aspects: market liberalisation, market failure and UAS policy to show how all these issues fit together to inform the overall research direction.

Figure 1: Thesis structure



Chapter 4 presents the method and methodology for the current study by arguing that the adoption of a multi-case study approach was informed by the nature of the research problem - to explore and understand a social phenomenon focused on mobile coverage in the context of Africa. The multi-case study approach is supported by 28 semi-structured interviews from a variety of stakeholders with hands-on experience and key roles across different African countries. The chapter describes how data was collected using different methods, the procedure that was followed to execute coding and data analysis, and the need for data triangulation using evidence from multiple sources like country analysis and the literature recounted in Chapters 2 and 3. This helped to strengthen the validity and reliability of the study. The chapter concludes with a causal map that highlights how the overall issues that emerged from the data connect and interact with each other.

Subsequent discussion in Chapters 5, 6, 7 and 8 cover the empirical domain of the thesis based on the evidence from the 28 interviews supported with country examples from across Africa as well as other parts of the world where the recommendations of interviewees have been implemented and Latin American countries where USF originated from. Chapter 5 addresses RQ1 by presenting the findings from the data using the iterative framework outlined in Section 4.6.5. This process resulted in three themes: lack of strong ICT leadership and commitment, lack of economic feasibility and UAS complexity. These themes are presented in details using interview extracts and causal maps detached from the overall data map in Chapter 4.

Chapters 6 and 7 follows the same procedure laid out in Chapter 5, but with a particular focus on RQ2. The presentation for RQ2 was split into two chapters (6 and 7) to make it easier for the reader to follow given the length of the findings from the data. Four themes emerged in the process: improving the current form of USF, indirect market interventions, collaboration and innovative solutions for UAS. Since these themes unfolded as a result of the issues identified in RQ1, emerging issues were examined and linked back to the findings in Chapter 5. This helped to maintain a smooth narrative of events illustrating the interaction between issues as highlighted through various causal maps.

Drawing on the public interest and economic efficiency perspectives of market failure in Chapter 3 and the depth of the interaction between issues in the overall data

in Chapters 5, 6 and 7, Chapter 8 identifies two key underpinning issues – regulatory capacity and transaction costs of network deployment and maintenance – to develop a model for closing the digital divide. Regulatory capacity focuses on the need for regulatory authorities to have access to qualified staff, funding and skills to formulate robust UAS policies, implement and effectively monitor the operation of USF in order to ensure widespread mobile coverage. On the other hand, since MNO will typically base their decision to invest in network expansion on cost-benefit analysis, they often concentrate in the areas where returns are perceived to outweigh costs. This underlines the need to focus on how the transaction costs of network deployment and maintenance could be lowered so that it becomes feasible for MNO to provide services economically.

Chapter 8 critically analyse and discuss these key issues by drawing from the literature and country examples. A causal map is also provided to show high-level interaction and links between issues. This map is further decomposed into two sub-parts to help summarise emerging arguments as the discussion progresses. Drawing on the definition proposed for market failure in Chapter 3, this chapter argues that the issue of regulatory capacity and transaction costs should be viewed more as complementary issues. The key argument here is that in a liberalised telecommunications market, the effort of a government to achieve public interest objective of widespread coverage requires the cooperation and commitment of market actors like MNO. As such, a well-designed UAS policy should not only focus on equitable outcomes but also reflect (somewhat) market realities. This is to make network deployment more economically viable to encourage the participation of private investors. The chapter concludes that addressing these two fundamental issues is critical to mitigating market failure in telecommunications and closing the digital divide across Africa.

Chapter 9 concludes the thesis. It begins by highlighting the events that have transpired in the industry and then moves to underline the fundamental underlining issues. The thesis then ends by explicitly indicating areas where the study has contributed to existing knowledge, limitations of the study and suggestions for further research.

Chapter 2: Sector liberalisation, FDI and the spread of MNO

2.1 Introduction

This chapter will explore the transformation of the telecommunications sector in Africa from 1999/2000 to the end of 2016, highlighting the differences between state ownership of telecommunications and that led by competition. To achieve this, the chapter begins with a brief analysis of the pre-liberalisation era of state monopolies. The focus will then shift to market liberalisation and the impact of local[7] and multinational entities (MNE)[8] focused MNO on the sector. Given that FDI flows have been integral to the transformation of the sector, this chapter will also briefly examine FDI and its implication on the development of the sector as evident in the spread of the mobile footprint of MNO across Africa. While this discourse takes a broad approach using country examples from across Africa, an in-depth analysis of the 16 Eastern African countries will be explored to illustrate the problem of 'digital divide' in the continent. This decision was informed by the fact that despite having, on the average, more MNO than other regions in Africa, Eastern Africa has the lowest mobile penetration levels (see Figure 4 and Table 2). Moreover, it is impracticable for a single study such as this with its limited time frame to cover all the 55 countries in Africa in-depth.

Overall, the analysis in this chapter will provide evidence to compare sector performance between state monopoly and market-based model of telecommunications using mobile penetration rates (which is one way of measuring digital divide [Batura, 2016; Nishijima, Ivanauskas, & Sarti, 2017]) to highlight the level of transformation that has occurred in the sector. The chapter concludes that while market liberalisation has brought an unprecedented level of transformation to the telecommunications sector compared to the era of state monopolies, a considerable number of people remain either underserved and/or unserved, allowing a 'digital divide' to emerge.

[7] MNO that operate in a single country in Africa

[8] MNO (pan-African and international) that operate in more than one country in Africa

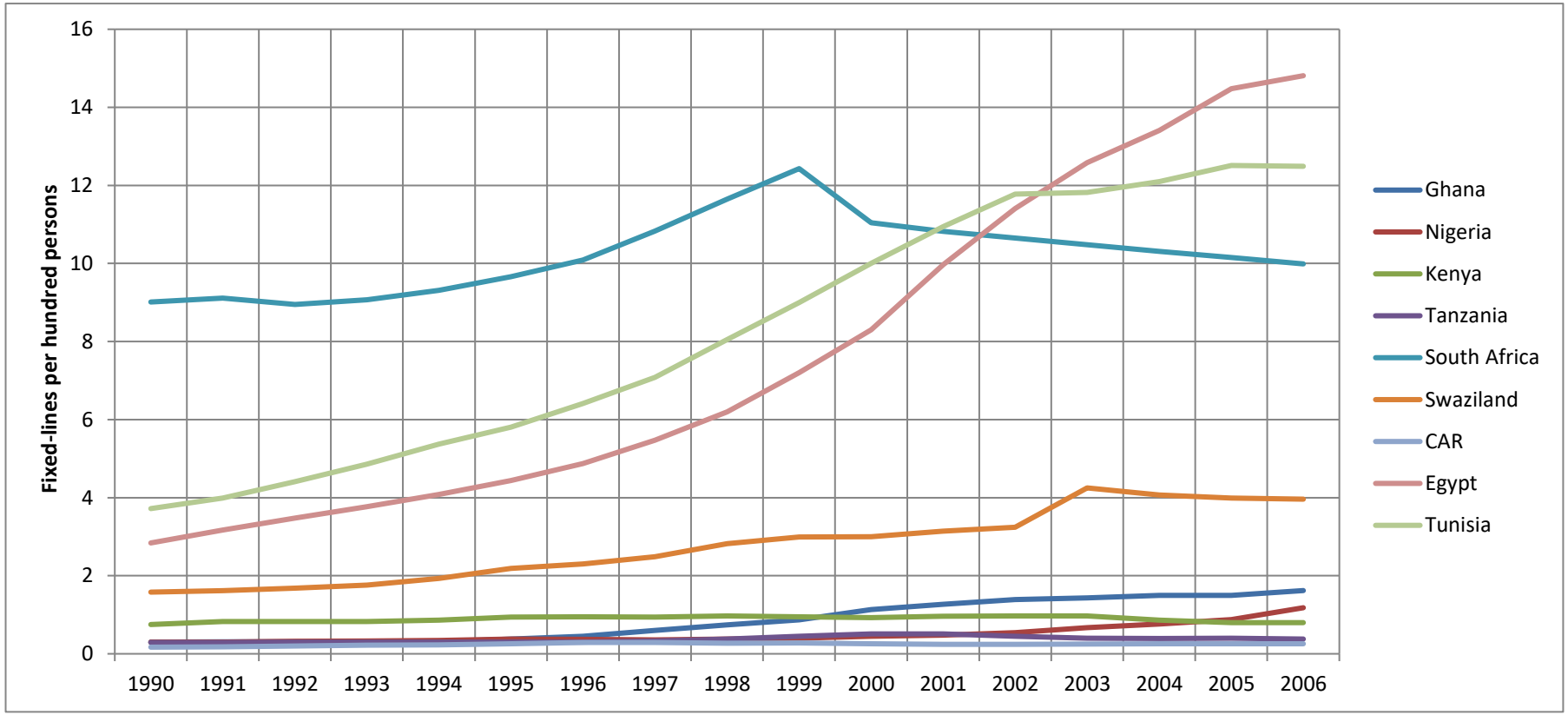
2.2 An overview of the telecommunications market in Africa

Prior to the introduction of liberalisation at the turn of the millennium, the telecommunications sector in continental Africa was run by state monopolies largely providing fixed network and services (Chavula, 2013; ITU, 2009). The performance of these fixed incumbents was characterised by gross inefficiency in terms of their inability to provide widespread access to telecommunications due to limited investment and technical capacity (ITU, 1999; Okonjo-Iweala, 2012; Williams & Kwofie, 2014). The inefficiency of state monopolies can be demonstrated through the low levels of fixed-line penetration across the continent, albeit with varying degrees (GSMA, 2011; Minges, 1998). Take the cases of Nigeria and South Africa, two of the largest mobile markets in Africa in terms of subscribers and FDI flows (Curwen & Whalley, 2014; 2018; Dupasquier & Osakwe, 2006), for example. Prior to 2001, state-owned Nigeria Telecommunications Limited (NITEL), which was formed in 1985, was the sole provider of telecommunication services in Nigeria (Ndukwe, 2003; Odufuwa, 2012). At the end of 1998, NITEL was only able to connect around 400,000 out of over 100 million people in Nigeria, resulting in a penetration rate of 0.4% (Oyejide & Bankole, 2001). Majority of these lines were also concentrated in large urban areas like Abuja and Lagos (Ndukwe, 2003; 2005). With a long waiting list for services, NITEL was only able to provide 500,000 fixed lines in its 15 years of operation (1985 to 2000), representing 0.5% penetration or 5 lines per 1000 people (Ndukwe, 2005; World Bank, 2017). A considerable number of people living in Nigeria were, therefore, unserved (Ajayi, Salawu, & Raji, 1999; Ndukwe, 2005).

Although the performance of South Africa's state-owned Telkom, which was formed in 1990/1991 following the separation of telecommunications from the South African Posts & Telecommunications, surpassed that of Nigeria's NITEL, the wider impact of Telkom's performance also left much to be desired (Gillwald, Moyo, & Stork, 2012; Hodge, 2000). This is evident in the rather stagnant level of fixed-line penetration, which fluctuated between 4 to 5 million lines for a population of 40 million from 1991 to 2000, representing 12.5 lines per 1000 people (Horwitz, 1999; World Bank, 2017). Unlike in Nigeria where the gap in fixed coverage was restricted by location, the case of South Africa was a bit more complicated as coverage was polarised by location – urban and rural, and race – 'white' and 'black' population - during the apartheid regime (Horwitz, 1999; Morris & Stavrou, 1993; Moyo, 2018).

The cases of Nigeria and South Africa largely reflected the trends in Africa as state monopolies failed to address the gaps in telecommunications coverage (Ibrahim, 2012; ITU, 1999). Continental Africa averaged 1.5 fixed lines per 100 persons in 1994 relative to 65 and 47 lines per 100 persons in the United States and OECD countries respectively for the same period (Alemu, 2018). The 1.5 fixed teledensity is even more discouraging when one considers that 40% of these fixed lines were concentrated in South Africa in 1994 (Alemu, 2018). Overall, the highest fixed penetration rate achieved in Africa during the era of the fixed incumbents averaged 1.74 lines per 100 persons in 1996. This translates to about 4.3 million fixed lines for a continent that had over 760 million people in the same period (Minges, 1998). The situation was dire in Sub-Saharan Africa, which had 0.48 fixed lines penetration per 100 persons while other regions like East Asia had 8.23 and Latin America and the Caribbean had 13.21 fixed lines in the same period (Gebreab 2002; Minges 1998). Recent statistic suggests a further decline across Africa to an average of 1% (ITU; 2017c; Sharma & Gillet, 2014). Figure 2 helps to illustrate the trends of fixed-line penetration of selected countries from across the continent for a seventeen-year period.

Figure 2: A time series cross-country comparison of fixed penetration rate in Africa (1990-2006)



Data sources: Index Mundi (2017); ITU (2017c); World Bank, 2017.

Both Figure 2 and the analysis that precedes further help to illustrate the inefficiency of state-owned monopolies across Africa, particularly for the countries highlighted and their inability to close the gaps in telecommunications coverage. Figure 2 also supports the argument that majority of the telephone lines in Africa (pre-liberalisation) were concentrated in South Africa with the highest rate of 12.4% in 1999. This was closely followed by Northern African countries as illustrated with the cases of Egypt and Tunisia, which had 8.3% and 10% fixed penetration respectively in 1999. Countries in Eastern and Western Africa struggled to attain 1% fixed penetration for the period under review with Nigeria and the Central African Republic recording the lowest figures of 0.40% and 0.28% respectively. As illustrated previously with the cases of Nigeria and South Africa, the little coverage provided by state monopolies was largely concentrated in affluent and urban areas, which also had a long waiting list of unmet demand (Gebreab, 2002; Ndukwe, 2005). IFC (2016) stated that the number of people on the waiting list for Sub-Saharan Africa at the end of 1995 was about 1.5 million (IFC, 2016).

With poorly developed infrastructure, lack of widespread (fixed) coverage and a considerable level of unmet demand, there was increasing pressure on governments to extend the coverage of telecommunications. To do this, Africa countries needed investment[9] to finance the expansion of telecommunications infrastructure and technical capacity to manage and operate the process (Hudson, 2010; ITU, 2015). Since this was generally lacking across Africa, albeit in varying proportions between countries and regions, governments turned to the World Bank and its associated bodies for support (Irwin & Brook, 2003; Sutherland, 2014). Prime among the conditions for obtaining such support was the need to introduce wider sector reforms to attract private investment and restrict governments' involvement in the sector to focus more on policy formulation and regulation (Moshi & Mwakatumbula, 2017; Ndukwe, 2005; Williams & Kwofie, 2014).

The implementation of such reforms, specifically, the WTO Basic Telecommunications Agreement[10], stirred the liberalisation of the telecommunications sector in Africa, which began in the late 1990s and early 2000s (Etzo & Collender 2010; Thomas, 2014; van-Huyssteen

[9] While the exact amount of investment that is needed to close the digital divide in Africa remains elusive, it is estimated that between $100 to $120 billion is needed to close the digital divide across emerging markets in the next ten years (Zibi, 2018).

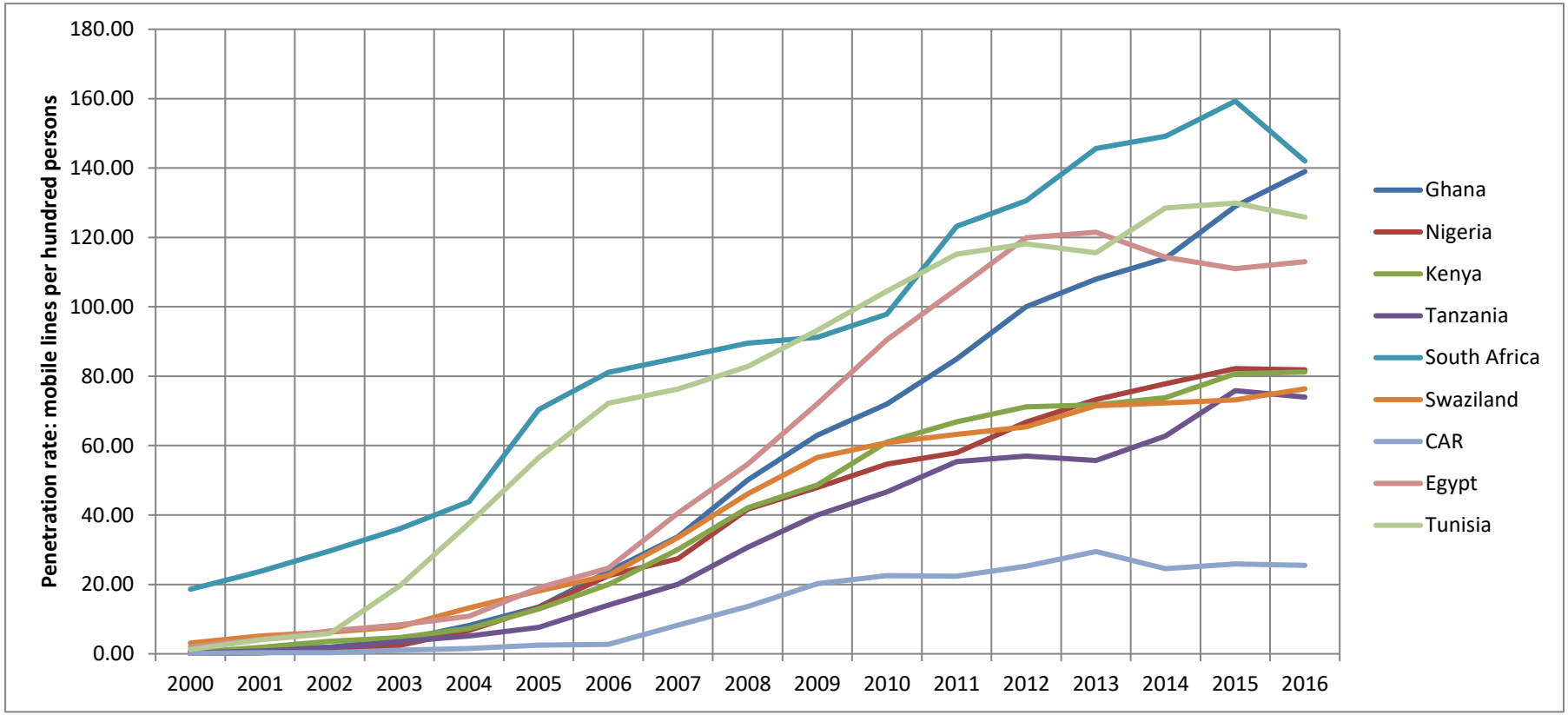
[10] See Section 1.1

2012). Governments across Africa gradually introduced liberalisation and embraced the use of mobile telecommunications with the understanding that it is more cost-effective to rollout and run mobile networks vis-à-vis fixed networks (Deloitte & GSMA, 2012; Souter, 2018a). Therefore, the switch from (expensive) fixed networks to (a more cost-effective) mobile solution was critical to the sector transformation (Andonova, 2006; Deloitte & GSMA, 2012; Economist, 2016). As such, the technological development offered by mobile has enabled countries across Africa to leapfrog years of neglect by fixed telecommunications (Economist, 2008; World Bank, 2017).

African countries, with the exception of four countries[11], have now opened up their telecommunications market, introduced competition and issued over 186 GSM licences at the end of 2016, 70% of which are either jointly or wholly owned by FDI focused MNO (Arakpogun, Wanjiru, & Whalley, 2017). This has resulted in a shift from an industry characterised by government-owned monopolies to a liberalised and competitive market that is vibrant and dynamic with a mix of local and MNE MNO (Chavula 2013; Hodge 2000; Muriu 2002). Unlike the unsatisfactory levels of performance witnessed during the era of state ownership, the activities of these MNO have not only contributed to an unprecedented level of investment but also the spread of mobile telephony and diffusion across Africa. Figure 3 helps to illustrate the trends of mobile penetration using the same countries and periods in Figure 2.

[11] Namely, Djibouti, Eritrea, Ethiopia and Swaziland (recently renamed the Kingdom of eSwatini [BBC, 2018]) - all operating state monopolies bar Swaziland where MTN is the private monopoly.

Figure 3: A time series cross-country comparison of mobile penetration rate in Africa (2000-2016)



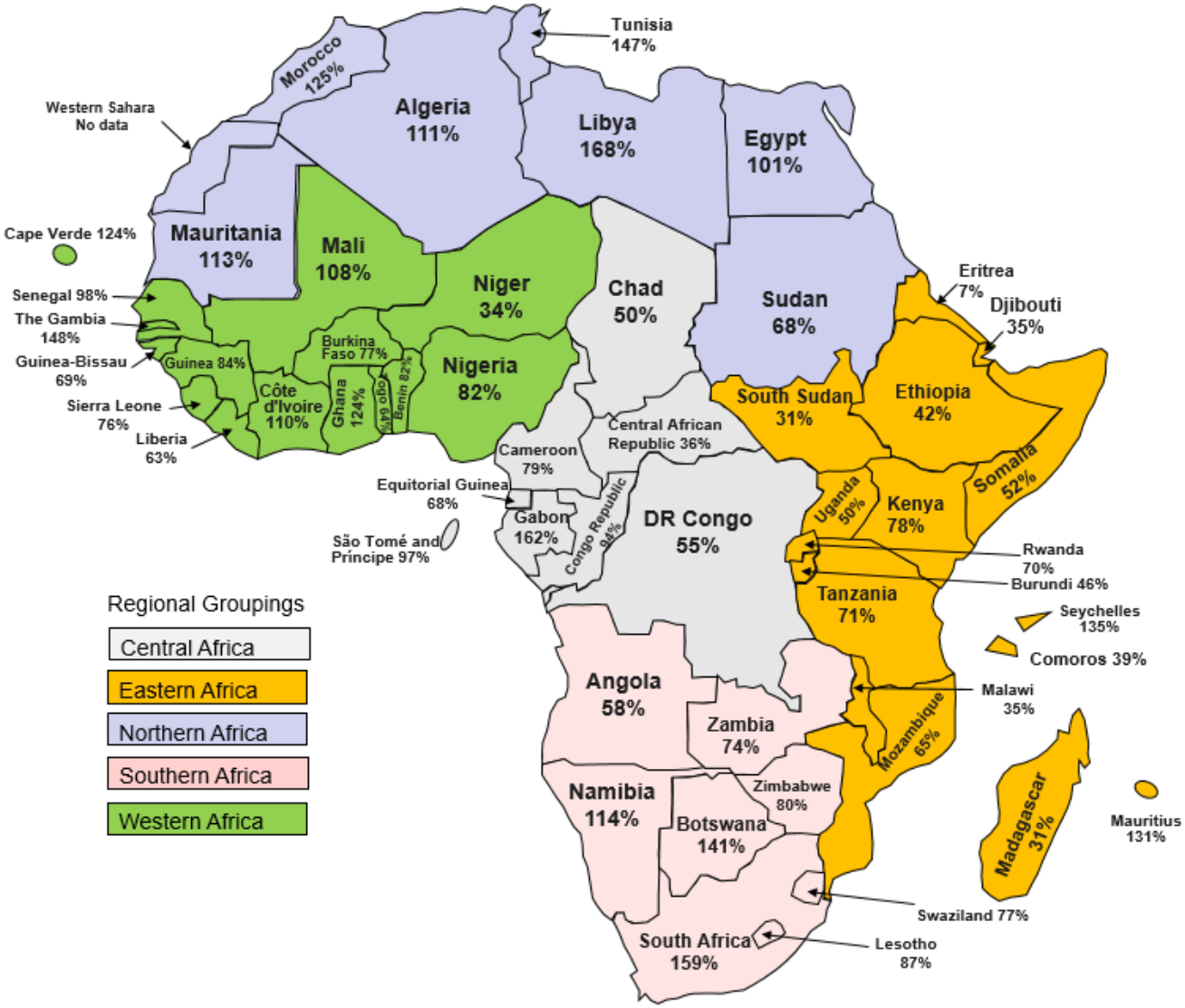
Data source: ITU (2017b); World Bank (2017)

In contrast to the low levels of fixed line penetration pre-liberalisation (Figure 2), Figure 3 suggests that competition has led to an unprecedented level of widespread access to (mobile) telecommunications. Take the countries with better statistics in Figure 2 as examples - fixed line penetration for Egypt, South Africa and Tunisia culminated in 8.3, 12.4 and 10% compared to mobile penetration of 121, 159, and 129% respectively from Figure 3. The comparison between Figures 2 and 3 also indicates that while NITEL was only able to provide 0.5% fixed-line penetration during its 15 years of operation, MNO provided 77% mobile penetration in Nigeria for the same period. South Africa's Telkom, on the other hand, provided 10.48% fixed-line penetration compared to 145% mobile penetration by MNO for the same 15 years. This trend is a reflection of various countries when we compare the rates of fixed and mobile penetration across countries. Overall, the contrast between Figures 2 and 3 suggests that competition has transformed the telecommunications sector in terms of providing access to telecommunications for millions of people across Africa, a feat that state monopolies could not achieve.

While the use of fixed line continues to decline, mobile adoption has increased significantly, fitting with the assertion that massive uptake of 'modern technology' leads to a sharp decrease in the usage of old ones (Hasbi, 2015). Apart from the legacy problem of a lack of fixed infrastructure, other reasons for the near demise of fixed-line are due to the high transaction costs for deploying fixed infrastructure, its limited functionality and lack of portability compared to a mobile phone (Curwen & Whalley, 2014; Deloitte & GSMA, 2012). Most people across Africa are increasingly opting for mobile phones instead of fixed lines, as the former does not depend constantly on electricity, which is largely unavailable in most countries (Economist, 2005; Tucker, 2017). There is also the issue of the unbanked now having access to some form of banking services through the use of mobile phones even when a physical banking structure is not available. In a country like Nigeria for example, which has over 170 million people, the Central Bank of Nigeria stated that some 50% of adult have no access to the traditional banking system (Chima, 2016; Thomas, 2013). The introduction of mobile money is helping to bridge this gap. The mobile ecosystem has also extended to other value-added services such as education, health, politics and social media (Layton and Elaluf-Calderwood, 2016). This clearly signposts that mobile is at the centre of life in Africa. Therefore, in stark contrast to fixed-line, mobile penetration and diffusion across Africa are increasingly becoming a critical socio-economic enabler (Aker & Mbiti, 2010; Haftu, 2018).

In contrast to the estimated 4% of mobile penetration prior to the sector liberalisation, the continent averaged over 50% at the end of 2016, an equivalent of '500 million' mobile subscribers (GSMA, 2017b; ITU, 1999). However, while there is a considerable number of mobile phones than ever before, Figure 4 indicates that mobile penetration and adoption vary across Africa. Countries with fewer MNO (mainly) located in northern and southern Africa appear to have high mobile penetration rates while countries from other regions like Eastern Africa have more MNO, but lower mobile penetration levels – with almost half of the 16 Eastern African countries, including Burundi and Malawi, recording below 50%. In contrast to other parts of the continent, the Central African Republic in Central Africa is the only country with a mobile penetration rate that is below 50% as shown in Figure 4.

Figure 4: Regional groupings and mobile penetration rates across Africa for year-end 2016



Data source: GSMA (2017a)

Before proceeding, it is necessary to state here that there is a lack of consensus when it comes the regional sub-division of Africa. This is particularly evident in the case of the Eastern Africa region. For example, while GSMA (2017) lists 9 countries (including Malawi and Tanzania) under Eastern Africa, Blycroft (2016) identifies 12 countries (including Zambia and Zimbabwe), AU (2018) presents 14 countries (including Sudan and South Sudan) and UNICEF (2008) defines the region as having 16 countries (see Appendix H for the full listing). While all the countries in AU (2018), Blycroft (2016) and GSMA (2017) intersect with the UN regional definition outlined in UNICEF (2008), the inclusion of Zambia and Zimbabwe in Eastern Africa by Blycroft (2016) appears odd given that these two countries are geographically located in the Southern Africa region (AU, 2018; CIA Factbook, 2018; GSMA, 2017; UNICEF, 2008). Therefore, these countries are not identified as part of Eastern Africa in this study as illustrated in Figure 4. This study adopts the UN definition contained in UNICEF (2008)[12] and argues that there are 16 countries in Eastern Africa as shown in Figure 4. One of the advantages of adopting this position is that since it is based on the UN regional classifications, it is arguably more credible given that over 150 member states coalesce under the UN, including 54 of the 55 countries in the Africa Union (AU) with the exception of Western Sahara. One could also argue that such credibility makes the UN position far more popular and appealing. Furthermore, the UN classification of Eastern Africa is apposite because it provides an amalgamated view of the different positions in Appendix H and reflects a broader and more encompassing definition for the purpose of the analysis that follows, and given that it has 13 countries overlapping with the AU, Blycroft and GSMA positions as indicated in Appendix H.

While the classification of the Northern African region is not as divisive as Eastern Africa, it is important to also highlight that countries in this region are sometimes classified as 'Arab States' and/or the Middle East and North Africa (MENA) (Blycroft, 2016; UNESCO, 2017; UNICEF, 2017). The reason for this is that countries that are geographically located in Northern Africa like Egypt and Tunisia are grouped together with other Middle Eastern states like Qatar and Saudi Arabia, perhaps due to their shared Islamic religion and, to some extent, (Arab) culture. Since Africa is the 'case' and focus of this study, the Middle Eastern countries

[12] https://www.unicef.org/wcaro/WCARO_SOAC08_Fig011.pdf

are not covered and, as such, Northern Africa is adopted as a more nuanced reference to focus on those countries geographically located in Africa (AU, 2018).

That said, although Figure 4 clearly shows that Eastern African countries are worse off when it comes to uneven mobile coverage in Africa, the headline figures of the 55 countries in Africa also suggests that coverage gaps persist between countries and regions. Overall, Figure 4 provides a mixed picture to suggest that countries across Africa have not benefited from market liberalisation and competition to the same degree. The position is further complicated when one considers the issue of multiple SIM[13] usage and inactive lines, which combine to inflate mobile penetration rates (Curwen & Whalley, 2014; Sunderland, 2009). Evidence from the country analysis conducted in this study indicates that in Eastern Africa, only Madagascar reported a drop in the level of mobile subscription from 40% in 2012 to 30% in 2014 because of the disconnection of inactive SIM (BMI Research, 2015). This suggests that accurate and relevant data on mobile penetration is lacking. The case is not different for countries that have over 100% mobile penetration – an indication that there are more mobile phones in the country than there are people, which is not true in reality.

Multiple SIM usage thus highlights the need for policymakers[14] to differentiate subscribers from subscriptions as one subscriber may have more than one subscription or one subscription being used by several people, thereby *"…bloating the total number of subscription"* (Matinde, 2015). This suggests that multiple SIM usage complicate and, to some extent, underestimate the issue of digital divide as the headline figures of mobile penetration appear to be overstated across Africa. See Section 6.2.6 for the case of Umhlabuyalingana municipality in South Africa where over 150,000 people are unserved despite having a mobile penetration of over 100%. In view of this, this study proposes that instead of using the term 'mobile penetration rate', a rather more appropriate term may be 'sim card connection' especially when it comes to a continent like Africa. It should, however, be mentioned here that this is not only applicable to Africa alone as Sutherland (2009) pointed out that even advanced countries are also involved in this practice with many people now owning multiple ICT devices like smartphones and tablets. While factors such as poor quality of service (QoS) and promotional offers from MNO are the main drivers of multiple SIM usage in Africa, the increasing ownership of multiple ICT devices appears to be the push factor for the advanced

[13] Subscriber identity module

[14] Policymakers in this study include governments, regulators and USF managers

countries (Matinde, 2015; Sutherland, 2009). Having said that, regardless of the level of distortion that multiple SIM usage has on the measurement of digital divide in Africa, there is no denying the fact that market liberalisation and competition have transformed the telecommunications sector, providing an unprecedented level of mobile penetration and adoption. Key to this transformation is FDI flows, which is the main driver of the internationalisation of MNO and their mobile footprint across Africa.

2.3 FDI and the spread of mobile network operators in Africa

By comparing the performance of state monopolies with and market-oriented MNO, the proceeding section has illustrated that liberalisation and competition have transformed the telecommunications sector in Africa in terms of providing mobile coverage for millions of people across Africa. This transformation, stirred by a wider sector reform, has changed government participation from ownership to regulation, opening up markets to competition and FDI. This has led to the introduction of technological changes that are driving the improvement of telecommunication infrastructure and services.

In contrast to the dearth level of investment during the fixed incumbent regime, the activities of local and MNE MNO have attracted over $78 billion of FDI for the deployment of telecommunications infrastructure in Africa (Haftu, 2018; van-Huyssteen, 2012). Nigeria, which is the continent's largest market by subscriber with over 100 million mobile lines, attracted over $18 billion between 2001 and 2015 (Arowolo & Folarin, 2015; GSMA, 2017a). While the overall FDI flows for telecommunications in Africa doubled to $146 billion in 2015, $214 billion is projected for the continent by 2020 (GSMA, 2016a; van-Huyssteen, 2012). The telecommunications sector thus underpin and facilitate FDI flows in Africa (Arowolo & Folarin, 2015; GSMA, 2016a). However, such a projection may be hampered by the general 16% fall in global FDI flows from about $1.8 trillion in 2016 to $1.5 trillion in 2017, as is the case with Africa, albeit a 'marginal' decline of -1% between 2016 and 2017 to about $49 billion (UNCTAD, 2018).

The impact of this global decline varies across Africa with countries like Nigeria and Angola as the main losers owing to the volatility of crude oil price, which dropped FDI in Nigeria by -24% to about $3.4 billion and in Angola by -20% to around $3.3 billion in 2017 (UNCTAD, 2018). In contrast, FDI increased in countries like DR Congo and South Africa by 29% to about $1.6 billion and 43% to around $3.2 billion respectively in 2017 (UNCTAD, 2018). Despite this general decline, FDI flows into telecommunications in Africa is generally

expected to increase year-on-year as global growth, currently at 4%, continues its upward trend in 2018 outlook (Alemu, 2018; Kennedy & Schneeweiss, 2017; UNCTAD, 2018). While the USA, the UK and France remain the largest sources of FDI into Africa with a combined stock of over $180 billion, increasing activities from China, India and South Africa has not gone unnoticed (UNCTAD, 2016). This is particularly significant for China whose FDI flows into Africa has increased over the years from $9 billion in 2009 to $22 billion in 2014 and over $60 billion in 2017 (EY, 2017; UNCTAD, 2016).

That being said, as telecommunications market was liberalised, FDI emerged as a key driver of the internationalisation of MNO as they spread their footprint across Africa (Curwen & Whalley, 2014; 2018; Dike & Rose, 2018). This is further illustrated by the examples in Table 1 using data that was tracked and generated over three years as the case study database for this study was amassed from multiple sources like online media reports, regulatory documents, electronic information from MNO as well as primary information from interviewees.

Table 1: Examples of FDI strategy and mobile footprint of MNO across Africa as at 2016

Telco MNE	Home country	Country example	Brand & year of entry	FDI strategy	Local partner	Total number of footprint in Africa in terms of country	Total number of subscribers in Africa (millions)
Bharti Airtel	India	Ghana	Airtel 2010	M&A (75%)	Entered Ghana following a $10.7 billion acquisition of Zain (Kuwait) Africa operation. The government owns 25% stake through Ghana National Petroleum Corporation	14	76
		Rwanda	Airtel 2011	GI (100%)	Entered Rwanda after obtaining the third GSM licence for $30 million in 2011		
Econet	South Africa/Zimbabwe	Burundi	Econet 2006	JV (50.5%)	Entered Burundi via a JV arrangement with PME Africa Infrastructure Opportunities by acquiring Spacetel form ST Cellular SA. Later took full control of the business in 2010 by buying PME's 49.5% for $15 million	7	9
		Lesotho	Econet 2008	M&A (70%)	Entered Lesotho via a merger with the incumbent, Telecom Lesotho. The government retained 30% ownership in the business		

Telco MNE	Home country	Country example	Brand & year of entry	FDI strategy	Local partner	Total number of footprint in Africa in terms of country	Total number of subscribers in Africa (millions)
Etisalat	UAE	Egypt	Etisalat Misr	GI (66%)	Entered Egypt following the award of the third GSM licence for about $2.9 billion with local partners, Egypt Post and National Bank holding the remaining stake	11	50
		Mauritania	Mauritel 2014	M&A (41%)	Entered Mauritania following the acquisition of Vivendi's (France) 53% stake in Maroc Telecom for about $5.7 billion, who held 41% stake in Mauritel		
Millicom	Sweden	Chad	Tigo 2005	JV (87.5%)	Entered Chad via a JV arrangement with the government, but following a $60 million full acquisition of its partner's stakes in Guatemala (Navega) and Chad in 2009, Millicom now owns 100% of Tigo Chad	5	20
		Tanzania	Tigo 2015	M&A (85%)	Entered Tanzania via the acquisition of Etisalat's 85% stake in Zantel in a cash and debt buyout: paid cash of $1 and took over a debt of $74 million. The government retained the remaining 15% stake		

Telco MNE	Home country	Country example	Brand & year of entry	FDI strategy	Local partner	Total number of footprint in Africa in terms of country	Total number of subscribers in Africa (millions)
MTN	South Africa	Nigeria	MTN 2001	GI (76%)	Entered Nigeria via a 15-year GSM licence for $285 million. It is not clear who owns the remaining 24%	17	148
		South Africa	MTN 1994	GI (70%)	Began its operations in South Africa following the award of a GSM licence for an undisclosed fee. The Broad-Based Black Economic Empowerment Group (BBBEE) owns the remaining 30%		
Ooredo	Qatar	Algeria	Ooredoo 2007	M&A (51%)	Entered Algeria via a 51% stake acquisition of Kuwait's Wataniya share in existing Nedjma for $3.7 billion. The identity of the local investors who own the remaining stake appears unclear.	2	22

Telco MNE	Home country	Country example	Brand & year of entry	FDI strategy	Local partner	Total number of footprint in Africa in terms of country	Total number of subscribers in Africa (millions)
		Tunisia	Ooredo 2012	M&A (90%)	Entered Tunisia after the increasing its stake in Wataniya Group to 92.1% for $1.8 billion. The government of Tunisia holds the remaining 10%		
Orange	France	Democratic Republic of Congo (DRC) Equatorial Guinea	Orange 2016 Getasa-Orange 2000	M&A (100%) JV (40%)	Entered DRC following the full acquisition of Millicom's Tigo DRC operation for $160 million Entered Equatorial Guinea via a JV arrangement with the incumbent Getesa while the government holds the remaining 60% stake	19	85
Viettel	Vietnam	Burundi	Lumitel 2014	GI (95%)	Entered Burundi via the award of a fresh GSM licence for $10,000 with a commitment to expand rural coverage. Viettel holds a majority stake of 95% while a group of undisclosed 'local' investors holds the remaining 5%	4	10

Telco MNE	Home country	Country example	Brand & year of entry	FDI strategy	Local partner	Total number of footprint in Africa in terms of country	Total number of subscribers in Africa (millions)
		Cameroon	Nexttel 2012	JV (70%)	Entered Cameroon via a 70:30 JV arrangement with Bestinver Asset Management of Cameroon through the award of a fresh GSM licence for an undisclosed fee		
Vodafone/com	The UK	Ghana	Vodafone 2008	M&A (70%)	Entered Ghana via a 70% stake acquisition from the incumbent, Ghana Telecom for $900 million while the government holds the remaining 30%.	10	118
		Kenya	Safaricom 1999/2000	M&A (40%)	Entered Kenya following a 40% stake acquisition from the incumbent, Telkom, for $42 million. The government and the 'public' share the remaining stake: 35% and 25% respectively.		
Zain	Kuwait	Morocco	Inwi 2009	JV (31%)	Entered Morocco via a 50:50 JV with Al Ajial Investment Holding of Morocco for $324 million while the incumbent, Wana Corporate SA of Morocco holds the remaining 69%	3	12
		Sudan	Zain 2006	M&A (100%)	Entered Sudan via the acquisition of Mobitel, which was jointly owned by Celtel, Sudatel and others		

It is pertinent to state here that the financial implications of the various transactions in Table 1 vary, depending on the level of ownership. For example, the deal between MTC of Kuwait in the sale of Zain to Bharti Airtel in 2010 for about $9 billion remains the biggest consolidation in the industry until now (Ibrahim, 2012; Manson, 2013). MTC operated its African operations under the brand name Zain for 5 years across 17 countries before selling the business to Bharti Airtel for $9bn (Manson 2013). However, recent evidence suggests that Airtel has now scaled back its operations to 14 countries by exiting, for example, Burkina Faso and Sierra Leon in 2016, selling both operations to Orange as part of an effort to reduce its $12 billion debt burden in Africa (Prinsloo & Bax, 2017; TeleGeography, 2017a). Other smaller transactions have also taken place in different countries like the sale of Orascom Telecom's 100% stake of Telecel Globe operating both in Burundi as Leo and the Central African Republic as Telecel Centrafrique to Econet Wireless Group for $65 million in 2014. Additionally, in June 2015, Millicom acquired the 85% of Etisalat's stake in Tanzania (Zantel) for $1 in cash and assumed a total debt obligation of $74 million as highlighted in Table 1. The financial transaction in some cases appears to lack clarity due to a dearth of public information on what has transpired and some of the ownership structures are shrouded in secrecy.

Having said that, the evidence in Table 1 shows that while mergers and acquisitions (M&A)[15] is the preferred strategy for FDI flows in ten circumstances, green-field investment (GI)[16] and joint-venture (JV)[17] were preferred in five countries apiece. This suggests that M&A is the most popular FDI strategy adopted by MNO as they spread their footprint across Africa. However, one can also see from Table 1 that as some MNO increased their footprint in Africa, they adopted GI and JV in the earlier stage of market liberalisation, but as the market evolved, M&A appears to be the most preferred FDI strategy. This trend can be illustrated with cases of Econet in Burundi and Millicom in Chad as indicated in Table 1.

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[15] With M&A, a firm can enter into a new market by an outright acquisition of a local firm, wholly or partially (Cross, 2000; Ho et al., 2015).

[16] GI involves building a new subsidiary from the bottom-up (Barkema et al., 1996; Blanc-Brude, 2014; Cavusgil & Knight, 2015).

[17] A JV can be defined as a partnership in which two or more parties create an enterprise through equity commitment – with parties undertaking an active role in both or either the decision-making process and operations (Harrigan; 1999; Hennart, Sheng, & Pimenta, 2015).

International business literature (for example, Barkema et al., 1996; Blanc-Brude, 2014; Buckley & Casson, 1998; Buskley & Ghauri, 1999, Cavusgil & Knight, 2015; Erramilli 1990; Gerrath & Leenders, 2013; Hennart & Slangen, 2015; Minbaeva et al., 2014; Shaver, 2013) highlights that the implications of adopting any of these FDI strategies can be explained by the interactions between factors such as resource commitment, control, risk and return on investment (ROI). Typically, when a firm commits more resources to a business, it gains more control and with this comes higher risk and ROI (Hollensen, Boyd, & Ulrich, 2011; Young et al. 1989). Therefore, depending on the type of the FDI strategy a firm decides to adopt, there would be a trade-off between the various factors. For example, a firm that adopts a GI strategy would have a higher degree of control for committing more resources than a JV where control ranges from high to intermediate and medium, depending on the ownership structure (Anderson & Gatignon 1999; Hollensen, Boyd, & Ulrich, 2011). This also implies that in a GI, a firm would have a higher risk (and ROI) compared to a JV where risk (and ROI) could be spread among various parties. Thus, an FDI strategy that requires a greater degree of resource commitment would result in more control, more risk and more ROI, and vice-versa.

Drawing on this trade-off analysis, one can also argue that the various FDI strategies adopted by MNO in Africa have varied implications. For example, the case of Airtel entering the Rwandan market via GI would suggest that the Indian based MNO would commit more resources, in this case, 100% equity contribution, without diluting control and solely absorb the risk, and ROI from its business operation in Rwanda. In contrast, the case of Zain adopting a JV into the Moroccan market would suggest that the Kuwaiti based MNO with a 50% stake would assume the same level of control, risk and ROI while its local partner – Al Ajial investment Holding - would assume an equal share of control, risk and ROI.

Apart from the issues of control, risk and ROI, licence conditions with local and legal restrictions appears to have also influenced the FDI strategy adopted by MNO in Africa with the implication that foreign investors cannot fully own a mobile network unless they collaborate with a local partner(s) via M&A or JV. For example, in Kenya, the minimum threshold that must be made available to local investors is 20%, 25% in Tanzania and the indigenisation law in Zimbabwe compel MNE to provide majority shares to local investors (Baily& Hoskins, 2015; TeleGeography,

2017g). The costs implications of deploying network for new entrants and the availability of critical infrastructure like frequency spectrum may also influence the choice of MNO. An example of this is in Tanzania where Millicom acquired the 85% stake of Etisalat in Zantel for $1 in cash, assuming a total debt obligation of $74M, but now have access to spectrum in 850MHz, 900MHz, 1800MHz, and 2100MHz frequency bands (ITNews Africa 2015; TeleGeography, 2015b).

Overall, Table 1 indicates that MTN, the pan-African MNO based in South Africa, is the continent's market leader with over 148 million subscribers across 17 countries including Cote D'Ivoire, Botswana, and Nigeria where the majority of its customers are located - 55 million mobile subscribers at the end of 2016. MTN is followed by Vodafone/com[18], which has 118 million subscribers across ten countries including Egypt and South Africa. Vodafone/com second position is fuelled by its market dominance in Egypt and South Africa where it has over 40 million and 29 million subscribers respectively in 2016. It is interesting to note that although both MTN and Vodafone/com are headquartered in South Africa, the majority of their subscribers are based in Nigeria and Egypt respectively. The last player in Table 1 is Econet, which has over 9 million users across seven countries including Zimbabwe the home country of its founder and chairman[19] but headquartered in South Africa. Econet also has 5% stake in Airtel Nigeria (Mansfield 2012; TeleGeography, 2012b). Overall, Table 1 helps to strengthen the argument that the sector transformation has been underpinned and facilitated by FDI flows from the activities of MNO across Africa.

Regardless of the level of industry success that has occurred from FDI flows as demonstrated by the spread of MNO and the number of mobile subscribers in Table 1, Section 2.2 highlighted that the headline figures of mobile subscribers do not tell the full story as pockets of 'digital divide' persist across Africa. Since it is impracticable for a single study such as this with its limited time frame to assess the issue of 'digital divide' in all the 55 countries in Africa (AU, n.d.) in-depth, Eastern

[18] Vodafone (UK) and Vodacom (SA**)** are considered as a single entity in this research for the sake of simplicity and considering the fact that the former has 65% stake in the later after increasing its ownership share of 50% by an additional 15% for $2.47bn in 2008 (Cellular News 2008; ITNews Africa 2008b).

[19] Strive Masiyiwa (Mansfield 2012; Econet 2015).

Africa will be explored as indicated in Section 2.1. However, before going further on the analysis of Eastern Africa, it is useful to clarify what 'digital divide' means in this study.

2.4 Digital divide

Although 'digital divide' has been a long-term topic of discussion in countries like the United States in the context of UAS, the debate became more critical and widespread around the world with the technological changes that began in the late 1980s and early 1990s (James, 2007; van Dijk, 2005). Since this concept is driven by technological changes, the implication is that 'digital divide' has become a multifaceted concept that evolves with the fast-changing nature of technology (ITU & UNCTAD, 2007; Nsengimana, Kende, & Rose, 2015; van Dijk, 2005). This is reflected in the diverging definitions of digital divide.

Some studies have defined digital divide as unequal access to ICT (computer and mobile) devices and the Internet (Bartikowski, et al., 2018; Dewan & Riggins, 2005; ITU, 2017d; James, 2009; van Dijk, 2005; World Bank, 2016) while some see it as inequitable access to ICT and digital skills (Cullen, 2001; Light, 2001; van Dijk, 1999). ITU and UNCTAD (2007) examined digital divide in terms of the gap in access to fixed and mobile lines, the Internet and broadband. Shenglin et al. (2017) defined digital divide as the gap in 'usage' and 'access' of infrastructure between various groups and across geographies. Other studies explored digital divide from the standpoint of unequal access to telecommunications infrastructure and a lack of affordability for services and mobile devices (Nsengimana, Kende, & Rose, 2015; Philip, et al., 2017; van Dijk, 1999). Digital divide has also been discussed from the perspective of gender, which typically describes a situation where a disproportionate number of women lack access to ICT (Bills, 2016; Chen & Wellman, 2007; GSMA, 2015; Kiran, 2018; Majama, 2017; Willams, Millward, & Layton, 2019). This is problematic in any society, as digital gender parity is critical to the socio-economic development of any country, not least because wider access to ICT for women would trickle down to their families, communities, villages and the society at large (Chair, 2017; Chair & De Lannoy, 2018; WEF, 2017).

Existing studies (for example, Gillwald, 2017; Gillwald, Mothobi, & Radman, 2018; Mohamed Nour 2017; Mottin-Sylla, 2006; van der Spuy & Souter, 2018)

largely suggests that although men are generally more likely to have access to the Internet globally, digital gender divide is more prevalent in Africa. For example, while over 200 million men are more connected to the Internet than women across the world, the connectivity gap between men and woman in Africa is the largest with an averaged of 23% compared to 4% in Europe and Central Asia, 5% in Latin America and Caribbean, and 3% in East Asia and Pacific (Broadband Commission, 2014; GSMA, 2015; ITU, 2016; Mohamed Nour 2017). Notwithstanding the variations within countries, Mottin-Sylla (2006) further highlighted that only one woman is connected to the information society for every three men across Francophone African countries like Benin Republic, Burkina Faso, Cameroon, Mali, Mauritania and Senegal.

Similar findings are presented in a relative recent 'Gender Gap Audit' carried out by the Web Foundation where none of the 10 African countries (including Egypt, Ghana, Nigeria and Uganda) surveyed are on track to meet the Sustainable Development Goal 5 target of 2030 that is aimed at achieving universal and gender-equitable Internet access (UN, 2015; Brandusescu & Sambuli, 2016). At a micro level within a country, Gillwald (2018), drawing on data from 2017 RIA After Access survey, provides a mixed picture. For example, while 12% Internet usage gap exists between men and women in South Africa, Kenya has 31%, Tanzania has 32%, Ghana has 34%, Nigeria has 46% and Rwanda has over 60% (Gillwald, 2018). This goes to suggest that while South Africa appears to have the least digital gender gap among the countries covered by the 2017 RIA After Access survey, Rwanda seems to have the biggest gap.

The digital gender divide in Africa can be linked to multiple reasons. These include unaffordability of mobile devices and tariff given that more women are on low-income jobs, social-cultural norms where men are favoured to women in terms of, for example, access to education, social interaction and household chores (A4AI, 2017; GSMA, 2015; Hanna, 2017; Mottin-Sylla, 2006; Brandusescu & Sambuli, 2016). A combination of these factors is referred to as 'structural and cultural inequalities' where the lack of income and education are arguably the major cause of digital gender divide (Mottin-Sylla, 2006; van der Spuy & Souter, 2018). The digital gender divide in Africa has also been linked to a poor governance framework where policy failure that excludes gender targets from UAS is prevalent in various countries (Mohamed Nour 2017; van der Spuy & Souter, 2018).

Digital gender divide thus reflects a much more complex problem of gender and other structural inequalities particularly across Africa where it is much more significant, and generally across the world. Kiran (2018) thus concludes that gender inequality transfers offline divides into the digital space. That said, digital gender divide will not be further covered in this study given the first-level digital divide focus of this study as indicated earlier in Section 1.1.

The definitions discussed above suggest that digital divide is a dynamic concept that lacks a universal meaning as it is driven by different notions of ICT changes in terms of services, technologies and networks. However, for the purpose of consistency, digital divide (also called digital/coverage gap) in the context of this study, refers to inequitable access[20] to mobile telecommunications. This definition is apposite because mobile has replaced fixed-line as a source of communication and end-users across Africa can now access a plethora of telecommunication services through mobile telephony (Collett, 2016; Curwen & Whalley, 2018; ITU & UNCTAD, 2007; World Economic Forum, 2014).

Having established a clear definition, another interesting issue to address is the cause of digital divide. UNCTAD (2008) asserted that digital divide has various dimensions with a number of factors interacting to cause an uneven distribution of access to ICT (mobile telecommunications, in the case of this study). A synthesis from various studies (for example, Gillwald, 2010; James, 2009; Nsengimana, Kende, & Rose, 2015; Pick & Sarkar, 2015; Sciadas, 2005; van Dijk, 1999) presents wide-ranging factors. This includes **geographical conditions** where landlocked countries may find it difficult to deploy vital infrastructure like undersea cables and internet exchange point due to a lack of access to the sea (Nsengimana, Kende, & Rose, 2015). Challenging topographies such as mountains and wide expanse of uninhabited lands dividing communities as well as disproportionate population distribution between urban and rural areas also fall under geographical conditions (Bagchi, 2005; Billon, Marco, & Lera-Lopez, 2009; Pick & Sarkar, 2015). In countries and regions where this applies**, transaction costs** of network deployment may increase significantly and

[20] See Section 3.3.1 for the definition of access in the context of this study.

MNO may find it difficult to deploy telecommunications infrastructure (Pick & Sarkar, 2015; UNCTAD, 2008; van Dijk, 1999).

The aformentioned studies argue that high transaction costs lead to two possible scenarios. Firstly, MNO may be discouraged from investing in the expansion of telecommunications network, which will then hamper the **availability of critical infrastructure** (James, 2007; Quibria, Ahmed, Tschang, & Reyes-Macasaquit, 2003). Secondly, in places where MNO decide to invest, they may end up transferring the costs to end-users, raising **affordability issues** in terms of the inability of users to pay for services (Dasgupta, Lall, & Wheeler, 2001; Gillwald, 2010; ITU, 2017d; ITU & UNCTAD, 2007; Shenglin et al., 2017). The issue of affordability is also extended to the costs of ICT devices, without which users cannot access services (Shenglin et al., 2017; van Dijk and Hacker, 2011). Furthermore, there may be instances where the network is available but people may not use them due to **a lack of awareness** in terms of users knowledge of the various uses of technology in navigating their daily lives, and **a lack of local content** in terms having relevant services that users can relate with and are useful to encourage and drive mobile adoption and usage (Nsengimana, Kende, & Rose, 2015; UNCTAD, 2008).

There is also the issue of **a lack of digital skills** to educate users and help them navigate the operation of (mobile) devices as technology continues to evolve (Dewan & Riggins, 2005; ITU & UNCTAD, 2007; UNCTAD, 2008; van Dijk & Hacker, 2011; World Bank, 2016). Other studies linked digital divide to **telecommunications policy and regulation** in terms of sector reform and the impact of regulation acting as a hindrance or a facilitator of competition and market growth (Dasgupta, Lall, & Wheeler, 2001; Gillwald, 2010; ITU & UNCTAD, 2007). For example, the role of policy in determining the **market structure** in terms of the number of MNO in the market to stimulate economies of scale (Nsengimana, Kende, & Rose, 2015; van Dijk, 1999). Finally, digital divide can be explained by **socio-economic factors** accentuated by, for example, political instability, GDP, FDI flows and disposable income (Gillwald, 2010; Pick & Sarkar, 2015; Sciadas, 2005). It is also interesting to note that apart from high transaction costs, low disposable income (in terms of low income and cash to spend on things) between people also feeds into the affordability issue of mobile devices and services (ITU & UNCTAD, 2007; Quibria, Ahmed, Tschang, & Reyes-Macasaquit, 2003).

For example, Gilbert (2018b) highlighted the impact of low-disposable income on the digital divide by stating that low-income earners in South Africa tend to have limited access to mobile devices and services relative to high-income earners who have broader access in terms of mobile devices and network, fixed-line, fibre network and a swathe of ISPs. Gilbert (2018b) further indicated that MNO in South Africa appear to charge users (largely low-income earners) of small data bundles '11' times higher than high-income earners who can afford larger data bundles - leading to a so-called 'poverty premium' on mobile data. This supports the growing body of evidence (for example, Bezuidenhout, Leonelli, Kelly, & Rappert, 2017; Castells, 2002; Chen & Wellman, 2007; Fuchs & Horak, 2008) that argues that countries with higher structural inequalities[21] tend to lag behind when it comes to digital inclusion. In other words, the gaps in digital divide appear to have a relationship with the overall level of economic development of a given country with the implication that the less developed a country is, the more the digital divide and vice-versa (Mothobi & Gillwald, 2018; Steyaert, 2002; van Dijk, 2006). For instance, UNHDR (2018) indicates that Africa is among the least developed continent in the world when it comes to issues like education, gender gap, health and income. Similarly, although the liberalisation of the telecommunications market in Africa has led to unprecedented levels of mobile phones, Africa still lags behind other parts of the world when it comes to 'actual' mobile penetration and adoption, notably the Internet – with 25% penetration in Africa compared to the world average of 54% (GSMA, 2016a; ITU, 2016).

This pattern is also reflected between countries. For example, Ghana, Kenya and Nigeria, people with more education and higher income are 'consistently' more likely to afford and own smartphones, engage in social media and general internet usage than people who are less endowed with socio-economic and political capital (Chair & De Lannoy, 2018; Fuchs & Horak, 2008; Silver & Johnson, 2018). This is also prevalent in South Africa, the only country in the continent where 50% of the population is connected to the Internet (Gillwald, Mothobi & Rademan, 2018; Mothobi & Gillwald, 2018; Silver & Johnson, 2018). Drawing on evidence from RIA After Access Survey 2017, Gillwald (2018) indicates that South Africans with higher

[21] Structural inequalities in this study refer to disproportionate levels of access to socio-economic and political resources like education, employment, income, information, healthcare, etc.

income brackets tend to have greater access to mobile phones in general, smartphones in particular and Internet usage – for example, while people on the income bracket of 0-1, 583 South African Rand (ZAR) had penetration levels of 82%, 45% and 51% for mobile phone, smartphone and the Internet respectively, people on the income bracket of 57, 334-123, 417 ZAR had 100% penetration across the board.

Although global Internet usage is generally higher among developed and wealthier countries, the proportion of people online correlate with socio-economic conditions like GDP per capita (Silver & Johnson, 2018). This partly explains why countries like the UK, the US and Germany which have over $30,000 GDP per capita have an average Internet usage of 80% while African countries like Senegal, Kenya and Nigeria with $10,000 GDP per capita have an average Internet usage of 40% (Silver & Johnson, 2018). Hence, while global inequalities could be linked to digital divide, Africa is worse-off as a continent considering its high levels of structural inequalities, which also reflects significantly in the levels of digital divide.

The discussion above reflects the digital paradox given that:

> *... as more people are connected and can access more information and services, at higher speeds than ever before, digital inequality is being amplified, not reduced (Gillwald, Mothobi, & Rademan, 2018, p. 5-6).*

This is due to the fact that in the current era of digitisation, Internet access (which is largely through mobile telecommunications in Africa as indicated in Section 2.2) is increasingly becoming significant, not least, in accessing general information, education, job search, civic engagement and business opportunities (Fuchs & Horak, 2008; Gillwald, 2017; 2018; Heeks, Graham, & Kleine, 2018; Romero & Margolis, 2005; van Dijk, 2006). It then follows that digital divide amplify and entrench existing structural inequalities in Africa because the lack of (or limited) access to mobile telecommunications would also impact negatively on access to general information, education, job, civic engagement and business opportunities (Heeks, Graham, & Keleine, 2018, Steyaert, 2001). Hence the consequences of ‘falling’ through the net are wide-reaching for individual countries and the continent as a whole (Chen & Wellman, 2007).

That said, digital divide is multi-faceted as different factors interact to explain the concept (van Deursen & van Dijk, 2015). While the factors above underline that digital divide is a moving target that has various dimensions, one may ask if all these

factors are equally significant in terms of their propensity to push (improve) or pull (discourage) digital divide. The rather ambiguous nature of digital divide would mean that this may depend on the 'kind' of digital divide policymakers are trying to address. To this end, James (2007, p. 284) concluded that *"…the topic* [digital divide] *is highly fragmented in the literature, with few attempts to put the parts into a coherent analytical framework. More precisely, there has been no specific attempt to pinpoint the main issues that influence one's view of the importance of the digital divide and the policies demanded by the different points of view."*

When it comes to Africa, although Figure 4 helps to illustrate that digital divide of even mobile coverage persists across the continent, the specific factors responsible may become clearer with the analysis of various countries/regions. The next section explores Eastern Africa to illustrate the issues highlighted above. The reason is that although Eastern African countries have, on the average, more MNO than other regions, they also have the lowest mobile penetration levels in Africa as shown in Figure 4.

2.5 Country mapping for Eastern Africa

This section presents an in-depth country analysis of the telecommunications market of the 16 countries in Eastern Africa by drawing on data from multiple sources such as ITU, GSMA, the World Bank, TeleGeography and various regulatory websites. To gauge the reasons why these Eastern African countries have not benefited from market liberalisation and competition to the same degree, the various factors mentioned in Section 2.3 will be employed as a guide. For the purpose of simplicity, these factors will be deployed using 'push' and 'pull' factors – where push factors encourage mobile growth and pull factors discourage mobile growth. The summary of this analysis is contained in Table 2.

Table 2: Summary of country mapping of Eastern Africa as at year-end 2016

Country	Market structure	No. of operators	Total population (millions)	Rural population (as a % of total population)	National mobile penetration (%)
Burundi	Liberalised	5	11,178,921	88	46
Comoros	Liberalised	2	788,474	72	39
Djibouti	Monopoly	1	887,861	23	35
Eritrea	Monopoly	1	6,537,000	78	7
Ethiopia	Monopoly	1	99,390,750	81	42
Kenya	Liberalised	3	46,050,302	75	78
Madagascar	Liberalised	3	24,235,390	66	31
Malawi	Liberalised	4	17,215,232	84	35
Mauritius	Liberalised	3	1,262,605	60	131
Mozambique	Liberalised	3	27,977,863	68	65
Rwanda	Liberalised	3	11,609,666	72	70
Seychelles	Liberalised	2	93,419	46	135
Somalia	Liberalised	8	10,787,104	61	52
South Sudan	Liberalised	4	12,339,812	81	31
Tanzania	Liberalised	7	53,470,420	69	71
Uganda	Liberalised	8	39,032,383	84	50

The evidence presented in Table 2 indicates that half of the 16 countries in Eastern Africa have mobile penetration rate below 50%. Although over 50 countries have introduced competition across Africa, four countries still operate a monopoly, three of which are in Eastern Africa as shown in Table 2. Apart from Mauritius and Seychelles where the mobile penetration rate indicates 'full' coverage (assuming at least one mobile phone per person, which often is not the case due to multiple SIM usage), the other 14 countries still have a varied proportion of coverage gaps. One could argue that Mauritius and Seychelles may have achieved such result with push factors like small population size and geographical conditions with access to undersea cables. For example, Alcatel-Lucent was contracted by Seychelles Cable System to link the country to EASSy cables via Tanzania for $30M in 2010 (TeleGeography, 2010).

However, it raises the question if the success in Mauritius and Seychelles could be replicated in larger countries. Another striking contrast from Table 2 is Burundi. From a mobile penetration rate of 0.01% in 1997 to 46% in 2016, representing 619 and 4.7 million mobile lines respectively (GSMA, 2017a; Index Mundi, 2017).

Although this could be seen as progress, but considering a market that was liberalised in 2003 (AfDB, 2011), this level of achievement is somewhat discouraging. This is more significant when we consider that a market once served by six (now four) MNO have only managed to deploy under 5 million mobile lines to over 11 million people. Although the country experienced a 13-year civil war and a series of military coups (UN, 2014), which may have limited the development of the needed infrastructure, but so have countries like Rwanda and Somalia, yet they have managed to achieve better results. Table 2 indicates that at the end of 2016, the mobile penetration rates for Rwanda and Somalia were 70% and 52% compared to 46% in Burundi. Nonetheless, from the analysis carried out for Burundi, it appears that one of the pull factors limiting mobile growth can be linked to socio-economic factors like civil war and political instability. Geographical conditions, in terms of urban-rural population, could be another pull factor behind this seemingly snail-paced growth as nearly 90% of the people live in the villages while MNO cluster in and around the capital city and environs (World Bank, 2017). This is highlighted by the fact that although Burundi has 17 provinces, telecommunications is only available in seven provinces (BMI Research, 2014).

The state of the telecommunications market in Somalia tends to be an oddity in the Horn of Africa owing to the fact that the market started and evolved in the midst of a civil war complicated with the activities and extortion of Al-Shabab terrorist group and Somalia pirates (BBC Africa, 2014). For more than two decades, the market has been unregulated as it is only recently in May 2017 that the Ministry of Posts and Telecommunications began a public consultation on a 'Draft Communications Law' (TeleGeography, 2017e). Although the Al-Shabab led extortion still prevails until now even with the presence of a recognised government at the centre, the progress made in the unregulated era in Somalia raises a critical question: are government regulations a push or a pull factor for the development of telecommunications in the Horn of Africa? Bearing in mind that apart from Somalia, state monopolies control

telecommunications in the other three countries[22] in the Horn of Africa. Although Somalia was also a monopoly until the fall of the central government in 1991 (BBC Africa, 2014), following the breakout of the civil war, *"…there is no state-run monopoly which prevents new competitors being established"* (Winter, 2004).

One could then argue that an 'unregulated' market and competition appears to have acted as a push factor for mobile growth in Somalia as accentuated by a widespread network coverage, encouraged by regional proliferation of MNO, to the extent that farmers in the village can talk with their relatives even while working in the fields (Baidoamedia, 2013). Another push factor in Somalia's unregulated market was the prevalence of affordable mobile and fixed tariffs relative to its peers in the Horn of Africa. The average monthly tariff for fixed line subscription was $10 with unlimited local calls while it cost between $0.30 to $0.05 per minute for mobile call and Internet usage (Economist, 2005). Comparing these rates with those of other African countries during the period of the unregulated market, Somalia was found to have one of the lowest telecommunications tariffs in Africa (Mohamed & Childress, 2010; Osman, 2012; Winter, 2004). This appears to be a surprise considering there was no regulator to protect the consumers in this once 'free-for-all' market, neither was there a government to protect MNO from Al-Shabab extortion and service disruption (TeleGeography, 2011). It will be interesting to see how regulation will affect tariff when the government finally introduces, for example, sector-specific tax and licence fee for frequency spectrum, which will undoubtedly be part of the agenda of the new 'Draft Communications Law' undergoing public consultation (TeleGeography, 2017e).

Rwanda is another interesting case considering its history of political tension that led to a civil war between the Hutus and Tutsis culminating in a genocide that saw the death of over 1 million people and the destruction of infrastructure (BBC, 2014; KPMG, 2012). Consequently, telecommunications liberalisation and competition were introduced relatively late in 2006 as part of the government effort to rebuild the economy (BuddeComm, 2015). Over ten years, Rwanda has achieved a better mobile penetration rate as indicated in Table 2 relative to early liberalisation countries like Burundi in 2003 and Kenya in 1999 (AfDB, 2011). Evidence from the analysis

[22] Eritrea, Djibouti and Ethiopia.

indicates that a key push factor for mobile growth in Rwanda can be linked to an effective telecommunications policy and regulation encourage by a strong leadership from the government of President Paul Kagame (Gilbert, 2016a). This is reflective in the formulation and implementation of a robust regulatory framework by Rwanda Utilities Regulatory Authority (RURA). For example, poor QoS is an inherent issue across most African countries and MNO appear not to pay much attention to the complaint of end-users with respective regulators failing to hold MNO to account (Onyeajuwa, 2017).

However, RURA is among the few regulators at the forefront of addressing this issue dating back to 2008 when MTN Rwanda was fined $130,000 and $150,000 in 2012 for poor QoS (TeleGeography, 2008b; 2012). RURA also revoked the licence of RwandaTel in 2011 after multiple failings to meet QoS and coverage obligation even though this was the country's incumbent with government ownership (Balancing Act, 2011). It is only recently that the Communications Authority of Kenya (CA) began to act in this regard having fined the country's three MNO a combined $3 million for failing to meet 80% of QoS threshold for 2015/2016 (TeleGeography, 2018b).

The government of Rwanda has also implemented several infrastructure development policies and the proliferation of ICT devices. For example, although a landlocked country, the government has partnered with the World Bank to construct 2,300km of national fibre backbone across the 30 districts in the country for $40 million (TeleGeography, 2008a). This was subsequently followed by linking the national backbone to TEAMS submarine cable via Kenya, funded with $60 million infrastructure project, a link that now provides Burundi and the Central African Republic with undersea cable access (Balancing Act, 2009). The government also launched a credit scheme called 'one mobile per household' in 2008 to improve mobile coverage in the rural areas (Telegeography, 2008a). The initiative subsidised the cost of mobile phone to RWF13000, spreading the payment over 13 months with RWF1000 monthly. In the process, over 53,000 mobile phones were distributed to 15 districts across Rwanda (Balancing Act, 2008). These efforts have been critical to the spread of telecommunication network and services in Rwanda. Although some end-users in rural areas have benefited from initiatives like 'one mobile per household', affordability of data tariff and smartphones is among the pull factors restricting mobile

coverage for Rwanda's last mile (Nsengimana, Kende, & Rose, 2015). Other pull factors evident within a survey on Rwanda include a lack of awareness of the Internet and the availability of local content to drive mobile adoption and usage (Nsengimana, Kende, & Rose, 2015).

Another issue worth highlighting from Table 2 is that more MNO have not necessarily resulted in better mobile penetration considering countries like Burundi, Tanzania, and Uganda with four, seven, and eight MNO respectively, but have a lower mobile penetration rate. When compared with countries such as Mauritius, Rwanda, and Mozambique, which have three MNO apiece, it appears that countries tend to have better mobile penetration with a fewer number of MNO. While one may argue that a small island nation like Mauritius may not be a good comparison, all the countries in North Africa (excluding Western Sahara where data is not accessible) also have three MNO each with over 100% mobile penetration besides Sudan with 68% as indicated in Figure 4. Hence, the fact that countries like Tanzania and Uganda are performing below expectation with multiple MNO cannot be overlooked. The willingness of policymakers to continue to issue licences appears discouraging to the market with some MNO divesting their investments from such countries. For example, the Ugandan market has become so crowded that MNO like Airtel has voiced concerns over the issue stating that it is impossible for such number of MNO to serve a small market like Uganda profitably (Biryabarema, 2014; TeleGeography, 2014). The situation prompted Orange to partially divest 65.93% of its operations in Uganda to Africell Holdings of Beirut in November 2014 for $12 million (Linington, 2014; Olouch, 2014; TeleGeography, 2014).

Prior to this sale, Orange managed a rather insignificant market share of 3.3% of Uganda's 25.3 million total mobile subscribers. The situation is also not different in Tanzania where Millicom (the third largest MNO in Tanzania) acquired 85% stake of Etisalat (fourth largest MNO in Tanzania with a meagre 5% market share), held in Zantel for $1 in cash, assuming a debt liability of $74 million in June 2015 (Cellular News 2015b; ITNews Africa 2015; TeleGeography, 2015b). Curwen and Whalley (2014) thus asserted that this trend of overcrowding the market has given rise to 'a tail of small and weak operators. Policymakers will argue that the presence of more MNO in the market allows for better competition and mobile diffusion (Ombok, 2014), but evidence from this analysis proves otherwise. There seems to be no positive

relationship between a crowded market, such as, for example, Tanzania and Uganda, and an increase in mobile penetration. With a larger market like Kenya, which had four MNO now served with three following the acquisition of YuMobile by Safaricom and Airtel in December 2014 (TeleGeography, 2015b), Tanzania and Uganda may want to reconsider their licencing policy. This analysis thus indicates that market structure, in terms of the number of MNO vis-à-vis population size, could also be a pull factor limiting widespread mobile coverage in Eastern Africa. Furthermore, the analysis also suggests that both small operators and late entrants would find it difficult to grow in a congested market like Tanzania and Uganda.

Although liberalisation and competition were introduced to allow the market to provide widespread access to telecommunications, the country analysis in this section highlights some specific reasons why countries in Eastern Africa have not benefited from competition to the same degree as their northern, southern and western counterparts. This is not to say that digital divide does not exist in other regions in Africa as evident in Figure 4, including a mix of countries with mobile penetration rates above and below 100%. For example, ARPT[23] awarded the first UTS[24] project to the three[25] MNO in Algeria[26] in 2016 to deploy basic telecommunication services to 97 underserved locations across the country with a population ranging between 500-2000 people (TeleGeography, 2016b). This came eight years after the country first opened the tender for UTS in January 2008 with a request fee of 50000 Algerian Dinar (Telecompaper, 2008). In 2016, Chinguitel, the Mauritanian[27] fixed and mobile operator, completed phase one of the $1.7 million 'Northern Telecoms' scheme funded through APAUS[28] by deploying 11 BTS[29] in communities such as Bentili Ain and Bir Moghrein with phase two scheduled for 2017 (TeleGeography, 2016b). NCC[30] announced plans to extend mobile coverage to 40 million people across 207 unserved

[23] Algeria Regulatory Authority for Post and Telecommunications

[24] Universal Telecoms Service

[25] Djezzy, Mobili and Ooredoo

[26] Algeria has a mobile penetration rate of over 100%

[27] Mauritania also has a mobile penetration rate of over 100%

[28] L'Agence de Promotion de l'Accès Universel aux Services

[29] Base Transceiver Stations

[30] Nigerian Communications Commission

communities in Nigeria[31] in 2017 (Adepoju, 2017b). Part of the proposed solution is to allocate more spectrum in the 38GHz and 42GHz bands with the understanding that such frequency bands enable 'short hop', point-to-point terrestrial links and support multiple technologies like 3G, 4G, etc. (Adepoju, 2017b).

Therefore, although Eastern Africa appears to be more disproportionate, a varied degree of digital divide persists across Africa with the most disadvantaged people residing in suburban and rural areas (GSMA, 2013; World Bank, 2017). Hence, while market liberalisation has transformed the sector and enabled access to mobile phones more than ever before, mobile penetration and adoption varies between African countries so much so that nearly 'half' of the 1.2 billion people in Africa still lack a mobile subscription (A4AI, 2017a; GSMA, 2016b; Manson, 2013).

2.6 Conclusion

Telecommunications in Africa have witnessed an unprecedented level of transformation in terms of a shift from fixed to mobile telecommunications providing mobile coverage for millions of people across Africa. The key driver that shaped this transformation is FDI flows from local and MNE MNO. At the end of 2016, over 186 MNO were operating across Africa, 70% of which were either jointly or wholly owned by MNE (Arakpogun, Wanjiru, & Whalley, 2017). Table 1 indicates that MTN of South Africa is the overall market leader with over 148 million mobile subscribers. While the activities of these MNO have rapidly extended mobile telecommunications to millions of subscribers more than ever before, mobile penetration and adoption vary across Africa (GSMA, 2017a; ITU, 1999). Countries located in northern and southern Africa appear to have high mobile penetration rates while other regions like Eastern Africa lag behind. The mixed picture indicates that countries across Africa have not benefited from market liberalisation and competition to the same degree. The position is further complicated when one considers the issue of multiple SIM usage and inactive lines, which combines to inflate mobile penetration rates for both better-performing regions in northern and southern Africa and less performing regions like Eastern Africa.

[31] Nigeria has a mobile penetration rate of 82%

Of the 1.2 billion odd people in Africa, only about '500 million' mobile subscribers exist (Collins, 2015; GSMA, 2016b; 2017b; Manson, 2013; Nyambura-Mwaura & Akam, 2013). An indication that a large part of the continent is either unserved/and or underserved, allowing a digital divide to emerge and persist after nearly 20 years of market liberalisation. The effort of governments across Africa to tackle this market failure and close the digital divide of uneven mobile coverage gave rise to UAS policy. This will be further explored in Chapter 3.

Chapter 3: Market failure and universal access and service

3.1 Introduction

Compared to the low levels of fixed line penetration that prevailed across Africa during the state monopolies regime, Chapter 2 has shown that market liberalisation and competition, driven by the spread of FDI from local and MNE MNO, have led to unprecedented levels of mobile penetration in the continent. However, while sector transformation has enabled more mobile users than ever before, mobile penetration and adoption vary between African countries so much so that nearly 'half' of the 1.2 billion people in Africa are believed to lack a mobile subscription (A4AI, 2017a; GSMA, 2016b). This indicates that market liberalisation and competition have failed to bring widespread mobile coverage to everyone in the continent as promised by the sector reform (WTO, 1997, p.1), allowing a digital divide to emerge. Governments effort to tackle the market failure of digital divide in Africa led to UAS policy (ITU, 2013b; Oestmann & Dymond, 2008; Souter, 2016).

Countries in Europe, Latin, and North America, as well as Southeast Asia, have attempted to address the issue of digital divide through UAS policy (Batura, 2017; Falch & Henten, 2017; Longstaff, 1996; Stern & Townsend, 2007; Thai & Falch, 2017). Before going into the investigation of UAS, it is necessary to explore the theory of market failure in light of the fact that market failure is the justification of government intervention in the marketplace (Levine & Taylor, 2018; Ortiz, 2016; Stiglitz, 2010; Trubnikov, 2017). This analysis will help to provide the theoretical understanding for such government intervention and explore what kind of regulatory instruments governments employ to correct market failure (Dodgson et al., 2011; Stiglitz, 2010). Such an understanding will also be relevant in shaping the presentation of the findings and discussion later on in Chapters 5, 6, 7 and 8.

3.2 The theory of market failure

The role of government intervention in a liberalised market appears to be a complex topic that has attracted scholars from various schools of thought (Bergman et al., 1998; Wallis & Dollery, 1999; Stiglitz, 2010). Prominent among these schools of thought is the theory of market failure as proposed by welfare economists such as Bator (1958), Baumol (2004), Pigou (1932) and Samuelson (1954). In sum, these scholars argue that certain underlying conditions, for example, perfect information and sufficient demand,

need to be present for a competitive market to efficiently allocate resources. A lack of which will lead to socially undesirable outcomes and economic inefficiency, which ultimately results in market failure (Mitchell, 1995). While there is a noticeable consensus among scholars about the existence of market failure and that this phenomenon provides the intellectual argument for government interventions, such consensus seems to disappear when it comes to its definition. For example, while Arndt (1988: 222) simply described market failure as *"…referring strictly to the efficiency and growth promoting performance of markets",* Wallis and Dollery (1999: 16) referred to market failure as *"…the inability of a market or a system of markets to provide goods and services either at all or in an economically optimal manner"*. Further, Weimer and Vining (1992: 13) defined market failure as *"… a circumstance where the pursuit of private interest does not lead to an efficient use of society's resources or a fair distribution of society's goods"*, and Wolf (1987: 46) stated that market failure is a situation where *"… markets fail to produce either economically optimal (efficient) or socially desirable (equitable) outcomes…"*

It can be observed from these examples that market failure is defined either in terms of *economic efficiency*, that is, an optimal allocation of resource with a price that reflects some element of costs to serve the needs of the society, or *equity* in terms of ensuring equal opportunity for all members of the society (Bergman, et al., 1998; Todorova, 2016). This study draws on a synthesis of these views and defines market failure *as a situation where a competitive market is unable to effectively allocate goods and services equitably for the benefit of the wider society and efficiently to encourage market actors*[32]. In light of this definition, government intervention should not only reflect the benefit of the public (equity) but also stimulate competition (economic efficiency) even where it appears infeasible for the market to achieve economies of scale (Ortiz, 2016; Wenders, 1988). Furthermore, this definition is particularly significant in the context of this study to address the divergence between social benefits and private costs of telecommunications (Economides, 2004; Lindsey & Teles, 2017; Todorova, 2016). This suggests that neither policymakers alone nor market actors by themselves can guarantee both equity and economic efficiency

[32] For the purpose of this thesis, market actors include MNO, equipment and mobile device vendors as well as other private players in the telecommunications market in Africa.

except they work together and allow a joined-up solution for correcting the market failure to emerge as will be seen in Chapter 8.

3.2.1 Causes of market failure

Having established a definition of market failure, another vital issue to consider is the causes of market failure. As with its definition, the literature suggests a lack of consensus on the exact number of causes. For example, Stiglitz (1988 & 2008) identified eight causes while Wallis and Dollery (1999) emphasised six. Furthermore, Dassler (2006) and Gomez-Barroso and Feijoo (2010) broadly identify four causes. This thesis will focus on seven causes - natural monopoly, transaction costs, information asymmetry, incomplete/missing market, public good, network externality and macroeconomic conditions - due to their relevance to telecommunications. This will become clearer as this section progresses.

Natural monopoly helps to explain one of the causes of market failure (Christensen, 2010, Dassler, 2006, Pigou, 1932; Posner, 1974; Weimer & Vining, 2010). Generally speaking, for a free market economy controlled by the forces of demand and supply to be efficient in the allocation of goods and services, competition must be preferred to a monopoly (Cherry, 2015). However, it is argued that there are some industries that would be better served with one (monopoly) or limited suppliers (oligopoly) because of the large financial outlay required to supply infrastructure (Posner, 1968; Wenders, 1988). Such industries, offering utilities like electricity, transportation, telecommunications and water, are termed natural monopolies (Arndt, 1988; Dassler, 2006; Katz, 2004; Souter, 2018a). The key argument here is that due to the large capital requirements in these industries, a limited number of supplier may better serve a market to allow for the maximisation of economies of scale and avoid inefficient duplication of resources as indicated in Table 3. In the absence of this, inefficiency may result and lead to market failure (Wallis & Dollery, 1999).

Table 3 at the end of this section indicates that the natural monopoly argument in relation to telecommunications is critical when it comes to serving disperse and isolated communities economically – given that such locations lack a critical mass of people needed to recoup the large financial outlay for network deployment and

maintenance[33] (Gillwald, 2005a). Such disperse and isolated communities can be widely observed across rural Africa, albeit in varying degrees with Central and Eastern regions having the most spatial population distribution and settlement (GSMA, 2016b; ITU, 2013; Linard et al., 2012; World Bank, 2018b). This scenario makes it difficult to serve a large part of the population[34] in rural and isolated locations across Africa, which further adds to the high costs of deploying infrastructure, including national backhaul (A4AI, 2018; Deville et al., 2014). In such a case where the costs of infrastructure buildout are high and potential users are low, it becomes difficult for multiple and competing networks to recoup their investment in an economically efficient manner (Katz, 2004; Souter, 2018a).

With this in mind and considering that a critical mass of people is needed to gain economies of scale and justify the large investment on networks, Section 6.3.2 makes a case for natural monopoly through the issuance of non-competing licence to allow individual MNO to be the sole UAS provider for their allotted areas. This would then help MNO to maximise economies of scale, prevent network redundancy, avoid duplication of resources and make the business of network operation more sustainable compared to competing networks in isolated areas. Having said that, Posner (1968) asserted that for natural monopolies, government intervention might be needed to address certain concerns like equity, QoS, prices and incomplete projects.

Following from the above, a second cause of market failure can be due to **transaction costs**, especially in a marketplace where the operation of natural monopolies are not allowed even if the situation may warrant it like in the case of deploying services such as electricity and telecommunications to disperse and isolated communities (Arndt, 1988; Gabel, 2007; Newbury, 2013; Zerbe & McCurdy, 1999). Before going further, it would be useful to clarify the meaning of transaction costs in relation to this study considering that from 1937 when Roland Coase first advanced the concept, there appears to be an ambivalent view of this term (Allen, 1999; Wang, 2003; Williamson & Ghani, 2011; Sitko & Chisanga, 2017). For example, Allen (1991) stated that the aggregation of all 'necessary' resources needed to transfer, establish and maintain property rights is referred to as transaction costs. Bhardwaj and

[33] For example, see Section 7.3.3 for the capex and opex of deploying and maintaining BTS

[34] Over 50% of African population live in rural areas (World Bank, 2017).

Brooks (1992), Stoll and Whaley (1983), referred to transaction cost as the cost of investing in financial markets, including brokerage fees and bid spreads. Coase (1937; 1961) defined transaction cost as the cost of providing goods and services through the open market rather than within the firm. This includes costs associated with searching for market information, negotiation and enforcement. Since the definition of the term lacks a consensus, Allen (1999) asserted that a relevant definition would depend on what is being examined.

Thus, the definition of transaction costs in this study is through the lens of Óliver Williamson's transaction costs economics (Williamson, 1971; 1985; 1989; 1998; 2000; 2012). According to Williamson (1985: 1), *"a transaction occurs when a good or service is transferred across a technologically separable interface*." The costs of setting up and running this process are what Williamson refers to as transaction costs (1985). This is also in line with Arrow (1969: 501), who was among the first to link market failure to transaction costs, stating that transaction costs are costs associated with 'running the economic system'. Transaction costs in this study thus mean the costs of network deployment and maintenance.

Although transaction costs are prevalent in other industries, the deployment of telecommunications network is characterised by high levels of investment as stated earlier. Such investment results in substantial amount of transaction costs, including fixed costs, which are largely sunk[35] and variable costs[36] (Dodson, Hughes, Foster & Metcalfe, 2011; Miller, 1995; Park, 2009). Most fixed costs in telecommunications are sunk once the network is deployed because it is, at best, difficult or, at worse, impossible to recover a large part of the investment where an operator does not succeed and/or wants to exit the market (Gilbert, 1989; Kim, Park & Jeong, 2004). A relevant example of the worst case is a fixed access point that provides subscribers' access to the local exchange, which is only valuable for transmitting services to that particular area (Falch, 1997). Examples of the difficult scenario could be evident in

[35] Sunk costs are irrecoverable costs of setting-up and running a business operation (Hausman, 1998).

[36] Variable costs include digging trenches for the laying of cables, setting up and maintaining billing system for collecting tariff and customer acquisitions in terms of advertising and marketing campaigns (Park, 2009)

recouping the initial (entire) costs of securing GSM/spectrum licence, deploying base transceiver stations (BTS) and fibre optic networks (Hausman, 1998; Park, 2009).

Since transaction costs form a significant part of telecommunications investment, it becomes imperative that the business case for network deployment is largely anchored on the net benefit of transaction costs (Cannock, 2001). In other words, MNO would only be interested in a market where accruing benefits outweigh the transaction costs (Wallis & Dollery, 1999; Dollery, 2001). If this is not the case, MNO would lose interest and the incentive to expand and continue serving such a market could dissipate (Hui, 2014; Williamson, 1971). While it possible for investors in other industries to exit the market in such a scenario, it is much more complicated and difficult for MNO due to irrevocable sunk costs as indicated earlier. One way to ensure that benefits outweigh costs is to set a price that reflects the high level of investment. However, the substantial level of transaction costs in telecommunications, which are largely sunk, would not allow the market to set a price that reflects the marginal cost[37] to recoup such investment (Hausman, 1998; Hausman & Sidak, 2014; Khan, 1988).

Table 3 thus highlights that idiosyncratic investment, largely reflected by high sunk costs and low marginal costs makes the economic feasibility of network deployment difficult. This is particularly significant in the context of Africa where transaction costs (fixed and variable) are significant owing to the legacy problem associated with a lack of infrastructure across the continent (Section 2.1). In this case, a government can use policy instruments such as taxation and other incentives to lower transaction costs (Gabel, 2007; Zerbe & McCurdy, 1999). This is further addressed in Section 3.2.2.

An additional cause of market failure is **information asymmetry**, that is, an unequal availability of information to everyone in the market (Bleda & del Rio, 2013; Dassler, 2006; Gomez-Barroso & Perez-Martinez, 2005; Stiglitz, 2016; Weimer & Vining, 2010). Studies have established that when it comes to access to information,

[37] Marginal cost is the cost of producing an additional unit of a product/service. Typically, the higher the total cost of production, the higher the price to reflect the additional marginal costs and vice-versa. However, when it comes to telecommunications, if price is to be set based on the actual marginal cost of deploying the network, mobile tariff becomes too expensive and may be priced beyond what a large proportion of consumers can afford. Hence, the reason why low marginal cost subsist in telecommunications despite having high transaction costs, which is sunk t a great degree.

market actors generally have far more advantage compared to consumers and government institutions (Dassler, 2006; Economides, 2004). As such, the industry can use this information to make better-informed decisions to the disadvantage of both the consumers and the regulators in a manner that 'games' the market.

Table 3 suggests that information asymmetry is particularly evident in the telecommunications industry in two ways. The first scenario is the information advantage of market actors over the institutions that are set-up to regulate the industry (Dassler, 2006; Dodson, Hughes, Foster & Metcalfe, 2011; Dollery, 2001). This is illustrated across Africa where market actors like MNO tend to have better information of, for example, where the biggest gaps of digital divide are over telecommunications regulators, including USF managers who administer market intervention policies like USF (Dorward, 2013; ITU, 2013b). One implication of this is that policymakers could misallocate USF to undeserving areas, that is, provide subsidies to MNO for serving profitable areas to the detriment of locations with 'true' access gaps as evident in Lesotho (Section 5.4.2). Furthermore, since MNO are aware of subsidies, they may use 'funding deficiency' as an excuse to delay network deployment just to benefit from USF even when they know that such areas could be served profitably (Xia & Lu, 2008). MNO can also use their information advantage for fixing prices and dictating the terms of QoS (Wallis & Dollery, 1999).

Gomez-Barroso and Perez-Martinez (2005) introduced a second dimension to information asymmetry in telecommunications by arguing that for a consumer to appreciate the value of services such as the Internet, certain level of information and knowledge are needed, otherwise, people may undervalue their use. This could lead to low adoption, which, in turn, leads to low usage and revenue for operators as evident in some parts of Africa (Sections 5.3.5). Drawing from Section 1.1, one can argue that while the first scenario speaks to the supply-side, this second point highlights some of the demand-side barriers of digital divide.

The subsequent analysis in Chapter 8 suggests that the first scenario highlighted in Table 3 could be addressed by empowering regulatory authorities with adequate capacity – financial and human resources. This will enable regulators conduct market research to reduce their information deficiency and promote better resource allocation for USF, carry-out wider stakeholder engagement in order to generate reliable information from, for example, local communities and share from

the invaluable knowledge of various interest groups. To mitigate the lack of knowledge from consumers, policymakers, as well as MNO, should promote public education and digital literacy programmes to encourage adoption.

Market failure can also stem from **incomplete and missing markets** (Dassler, 2006; Gomez-Barroso & Perez-Martinez, 2005; Ortiz, 2016; Stiglitz, 2010). The main tenet of a market economy is that all needs would be met by the market provided the demands of consumers are sufficient to absorb the corresponding costs of supply (Dollery, 2001; Wallis & Dollery, 1999). In the absence of this, market failure may arise due to incomplete market as suppliers neglect some part of the market due to a lack of demand. It then follows that incomplete market is a situation where the lack of certain required elements such as sufficient demand in the marketplace may lead to inefficiency and thus discourage the supply of goods and services (Beare & Newby, 2005). Missing market, on the other hand, arise from the absence of a complementary market, that is, an instance where the activity of one market is dependent on a related activity (Beare & Newby, 2005; Dollery, 2001; Laffont, 2005; Stigliz, 1988).

Incomplete market is evidence in telecommunications when we consider (as argued earlier under natural monopoly) that a critical mass of people is needed to justify the large investment on network deployment. If this does not eventuate, the business case for network expansion dissipates as MNO would typically concentrate in commercially viable areas with greater demand (Ndukwe, 2003; 2005). As for missing market, for the telecommunications market to be optimal, apart from providing network, end-users need affordable mobile phones and tariffs to maximise the demand for services (Gillwald, 2017; Chair & De Lannoy, 2018). This indicates that the supply of network and the demand for services are complementary - one cannot succeed without the other. Hence, if end-user cannot afford mobile devices or tariffs even when there is a network, a complementary segment of the market is said to be missing. This results in market failure as evident in Section 5.3.4. This suggests that the sum of parts of network supply and service demand are important as the whole. Therefore, MNO may not go out of their way to meet the needs of the market for both incomplete and missing markets without some form of government intervention and/or support (Wallis & Dollery, 1999).

Section 6.3.2 later suggests that incomplete market can be mitigated through rationing disperse and isolated communities (where demand is disaggregated) among

individual MNO and issuing them with non-competing licences to promote economies of scale and maximise demand for such areas as indicated in Table 3. Table 3 also indicates that missing market can be tackled by addressing affordability barriers associated with, for example, the cost of smartphones and data tariff to promote adoption (see Section 5.3).

Another cause of market failure can arise from a lack of ability of the market to provide **public or merit goods** (Arndt, 1998; Gomez-Barroso & Feijoo, 2010; Weimer & Vining, 2010). Generally speaking, a public good is one in which the consumption by one member of the public does not exclude its availability or consumption to another (Gomez-Barroso & Perez-Martinez, 2005; Stiglitz, 1988; Zerbe & McCurdy, 1999). Conversely, a merit good is a product/service that is of immense benefit to the public but may be underprovided by the market due to insufficient demand or the inability/willingness of the public to pay (Ali, 2016; Musgrave, 1957). Due to the positive externality that comes with such good in terms of the wider socio-economic benefit, governments tend to take interest in its widespread provision regardless of consumption habit (Ali, 2016; Bergman et al., 1998; Gomez-Barroso & Perez-Martinez, 2005). A common example of such good includes education (UNESCO, 2018).

Whatever the 'generic' term that applies, when such good is produced, its aforementioned characteristics of non-excludability and non-rivalry could mean that users cannot be prevented from using it even if it is becoming economically inefficient to the market (Eliassen & From, 2009). Hence, the market may lack the incentive to meet the needs of the wider society owing to a lack of profitability but considering its wider socio-economic benefit, governments may intervene to ensure its availability to the society (Dassler, 2006; Wallis & Dollery, 1999).

Although the increasing importance of telecommunications as a critical tool for promoting social-economic activities has led to its classification as a public and merit goods (Dassler, 2006; Falch, 1997; Eliassen & From, 2009), Gomez-Barroso and Feijoo (2010) argued that telecommunications is neither a public nor merit good but a mixed good. In the sense that telecommunications reflect an attribute of a public good in terms of public use without diminishing quality and a private good where a member of the public may be excluded due to, for example, ability to pay (Gomez-Barroso & Feijoo, 2010; Mitchell, 1995). Furthermore, since a public good is generally

believed to attract zero marginal cost for an additional consumer, the high transaction costs, which is largely sunk, in telecommunications counters such argument – low (not zero) marginal costs is often related with telecommunications (Hausman, 1998; Hausman & Sidak, 2014; Stiglitz, 1988).

This study adopts the viewpoint of a mixed good because this reflects both the public interest and economic efficiency perspectives of correcting the market failure associated with telecommunications as explained in Section 3.2. Mixed good is further illustrated by UAS to telecommunications (Dassler, 2006; Wellenius, 2000; Wright, 1999). Since UAS involves the provision of telecommunications in a manner that is widely available, accessible and affordable, it becomes difficult to achieve this by solely relying on market forces. Additionally, the liberalisation of the market also implies that UAS could no longer be achieved through cross-subsidisation as competition reduced the ARPU of the incumbent (see Section 3.3.2). Table 3 indicates that this has resulted in government intervention through, for example, USF in over 30 African countries as market forces alone cannot guarantee UAS to telecommunications. See Section 3.4 for the analysis of USF across Africa.

Network Externalities can also lead to market failure (Park, 2009; Stiglitz, 2000; 2008; 2016). Externalities generally occur when a shift (increase or decrease) in demand for goods/services by an individual impacts an unwitting third party (Stiglitz, 1988; Chung& Yoo, 2015). Hence, network externality can be defined as the change in the benefit that one derives from a product when the number of people consuming the same product changes (Baraldi, 2008; Liebowitz & Margolis, 1995). Dollery (2001) and Stiglitz (2008) further argued that externalities derive from the relationship between production and consumption patterns, which leads to the divergence between private costs and social benefits. The impact could be positive or negative with the later leading to market failure. For example:

> *…if a manufacturing plant discharges industrial effluent into a lake thereby poisoning fish and harming the local fishing industry, then this would constitute a negative production externality. By contrast, industrial agglomeration along the lines of Silicon Valley represents a positive production externality where separate economic activities reinforce one another and lower production costs* (Dollery, 2001, p. 11-12).

In telecommunications, network externality results when the value of being on a network depends not only on an individual but also on the size of the network in

terms of the level of deployment and adoption by other users (Mayo & Wallsten, 2011; Souter, 2018a). Although there is a variety of products/services for which the utility derived by a single user increases with the consumption by other users, network externality is arguably more pervasive and problematic in telecommunications (Chung & Yoo, 2015; Iimi, 2007; Katz & Shapiro, 1985; Trifunovic & Mitrovic, 2016). This is illustrated by Mitchell (1995) who asserted that telecommunications users tend to get more value from being on a network that has more users as they pay a lower On-Net tariff to connect with more people relative to paying the higher Off-Net tariff.

Mitchell (1995: 195) further added that the consequence of such externality is that "… *the social value of enlarging the network by one user exceeds the private value expressed in a potential subscriber's willingness to pay*." Consequently, although a larger player is able to maximise this effect through promotional offerings to its large subscriber base, a smaller player may be unable to appropriate this effect because of its limited customer base and network reach. Hence, an operator with a larger network could drive out the smaller players (Souter, 2018a). Mitchell concluded that this can prevent market actors, particularly, the smaller players, from expanding to other locations. In this sense, network externality can result in market failure.

While the above analysis is widely applicable to the telecommunications industry, it important to stress that context also matters. For example, Section 2.2 highlighted that the market structure of telecommunications across Africa, in term of the number of MNO and their respective subscribers, varies between countries and regions. Take Nigeria, a market with three major players – Airtel, Globacom and MTN, for instance. While MTN is the market leader[38] with over 50 million subscribers, a non-market leader like Globacom with over 30 million subscribers can also benefit from network externalities, not least, when we consider its number of users and network reach including the large investment in vital infrastructure like fibre optic (Akinyemi & Ramonu, 2018; GSMA, 2017a; Song, 2016b). This differs with a country like Kenya, where despite having two major players – Safaricom and Airtel - , Safaricom appears to be the MNO that benefits the most from network externalities due to its over 30 million mobile subscribers, wider network coverage and locking people in with its MPESA service (Section 1.1). It then follows that Airtel, which has

[38] MNO with the largest market share in terms of subscribers

about 5 million subscribers, finds it difficult to benefit from network externalities despite offering, on the average, lower mobile tariff relative to Safaricom (see Section 7.2.1). This is because Airtel lacks a wider network reach, the critical mass of people that is crucial for positive externalities (Baraldi, 2008; Falch, 1997; Iimi, 2007).

Drawing from Sections 3.2.2 and 8.3.2, Table 3 highlights that policymakers can mitigate market failure linked with (negative) network externalities directly through price intervention - the elimination/reduction of Off-Net tariff, which will then give national roaming to smaller players to interconnect with national networks of big players. Table 3 also suggests that an indirect approach implemented through incentives like timely access to affordable (low) frequency spectrum can also be part of the solution.

The final cause of market failure, within the context of this study, is the **volatility of macroeconomic conditions**, which leads to an economic downturn that disrupts the business cycle and limits the ability of the market to satisfy existing and potential demands (Gomez-Barroso & Perez-Martinez, 2005; Zerbe & McCurdy, 1999). Generally speaking, during periods of macroeconomic instability, the purchasing power of consumers may be restricted because of unemployment and low income, which may translate to low demand (Stiglitz, 1988). Suppliers may also be faced with the difficulties of obtaining foreign exchange (forex) for infrastructure expansion, especially in developing economies such as those in Africa where most telecommunications equipment are imported from overseas and payment is denominated in US dollars. In countries where this persist, market failure may result and may need government intervention to mitigate the impact.

An example of how such volatility can impact telecommunications is evident in Nigeria where the Central Bank of Nigeria (CBN) has injected over $9 billion into commercial banks to help businesses access forex during its recent recession (Fick & Pilling, 2017). However, such intervention appears to have come late following the exit of Etisalat from the market due to its inability to secure forex for its operation and service its $1.2 billion debts (Carvalho, 2017). A new venture called 9mobile, which is jointly owned by the creditors of Etisalat, has now taken over its mobile operation while the regulator searches for a new investor (Adepetun, 2017). Ohuocha and Eboh (2018) state that Teleology Holdings seem to be the front-runner to takeover 9mobile following a successful bid oversaw by Barclays Africa with about $500 million

acquisition price. Table 3 suggests that government interventions through fiscal and monetary policies can help to mitigate the volatility of microeconomic conditions but such interventions need to be timely to match the occurrence of the event in order to avoid the aftermath of the market exit of Etisalat in Nigeria.

In summary, while the literature - for example, Dassler, 2006; Stiglitz; 1988; 2008 - suggests a lack of consensus on the causes of general market failure, the discussion in this section highlights seven factors that are peculiar to telecommunications. Given that such factors can also help to explain market failure in general, this section makes a clear distinction by discussing how these factors may impact other industries in general and telecommunications in particular. Table 3 presents a summary of this discussion. The key argument in Table 3 is that although the aforementioned factors could result in market failure in other industries, their impact on telecommunications becomes clearer when we consider the summary presented below. Therefore, to close the market failure of uneven mobile telecommunications in Africa, these factors should be taken into consideration, as subsequently highlighted in the empirical analyses in Chapters 5 to 8.

Table 3: Nuances in market failure: general versus telecommunications

Causes of market failure	In General	In telecommunications	Suggested solution
Natural monopoly	Natural monopoly is largely and historically associated with utility industries like electricity, transportation and water. Since large investment is needed to deploy infrastructure in such industries, it is argued that it makes more economic sense to have a single (or a few) supplier(s) in order to produce economies of scale to maximise returns.	The argument for a natural monopoly in a liberalised telecommunications market is relevant when it comes to serving countries with large geographies and, disperse and isolated communities, considering that a critical mass of people is needed within an area to justify the high transaction costs of network deployment This would make it more economically feasible for individual operators to provide infrastructure and services across their designated areas with disaggregated population	Section 6.3.2 suggests that this can be implemented through the issuance of non-competing licence to allow individual MNO to be the sole provider of services in their allotted areas
Transaction costs	Generally speaking, when the transaction costs of engaging in any business are greater than returns, a market cannot function efficiently In this case, a market actor can either set a price based on higher marginal costs to account for the large investment or exit the market altogether	Since high levels of sunk costs are embedded in transaction costs, it is difficult to exit a non-profitable market without incurring a significant loss It also difficult to recoup investment by relying on 'standard' price set at an equivalent marginal cost as high margins would be needed to offset, not least, the fixed costs element of the transaction costs, and allow operators to earn a sufficient return on investment This would price services beyond the reach of a large number of consumers. Hence, despite the high transaction costs associated with telecommunications, low marginal costs are applicable	Section 6.3.3 indicates that policymakers can offer various incentives to help operators lower their transaction costs
Information asymmetry	Information asymmetry is observed in various industries when some market participants lack information to make an	Information asymmetry is evident in telecommunications through: the information advantage of MNO over regulators, which results	The analysis in Chapter 8 suggests that this can be addressed through adequate regulatory

	informed decision on issues relating to, for example, price and quality This generally creates a problem in the market as the participant(s) with the information advantage tend to exploit others	in, for example, the misallocation of USF to undeserving areas while 'true' disadvantaged areas continue to lag behind Secondly, this is highlighted in the lack of consumers' knowledge of the wider usefulness of being connected and mobile devices usage. This results in low mobile adoption and usage, which, in turn, leads to low revenue for MNO	capacity and promoting public education and digital literacy
Incomplete and missing markets	The success of any market is generally predicated on the interaction of the forces of demand and supply. That said, market actors would typically provide goods/services when there is sufficient demand to absorb the supply costs When this does not eventuate, market actors are more likely to neglect supply due to incomplete/insufficient demand. Conversely, the consumption of a product may be dependent on a related product, which when missing could restrict aggregate demand	Incomplete market is accentuated in disperse and isolated communities where demand is disaggregated and difficult to get a critical mass of people to make network operation attractive and profitable Missing market is reflected in the lack of complementary market between the supply of network and the demand for services	Section 6.3.2 suggests that incomplete market can be mitigated by issuing non-competing licences to designated natural monopolies for serving disperse and isolated communities Section 5.3 indicates that missing market can be tackled by addressing affordability barriers associated with the cost of smartphones and data tariff to promote adoption.
Public/merit/mixed goods	Although such goods are typically considered to be essential to the social-economic well-being of the wider society, the market may stop or inadequately provide them when it becomes unprofitable Government may then intervene due to their wider importance to the socio-economic wellbeing of the society	The increasing importance of telecommunications as a critical socio-economic enabler has resulted in its classification as a public and merit goods However, a mixed good is adopted in this study because this reflects both the public interest and economic efficiency perfectives of correcting the market failure of telecommunications as proposed in Figure 19 (Section 8.1)	UAS to telecommunications cannot be achieved by market forces alone but with the complement of government intervention Sections 3.3 and 3.4 indicates that such intervention is largely implemented via USF in over 30 African countries within the wider framework of UAS policy

			The idea is that USF would help to equate marginal social cost (as closely as possible) with market prices that reflect transaction costs of deploying network
Network externalities	Network externalities generally occur when a shift in demand for goods/services by one individual impacts an unwitting third party Since such impacts could either be positive or negative, production and consumption patterns could diverge with the implication that private costs and social benefits are largely isolated Market failure typically results in the event of negative externalities, i.e., when private costs exceed social benefits	Network externality is arguably more pervasive and problematic in telecommunications because: Subscribers tend to get more value from being on a network that has more users due to lower On-Net tariff relative to paying a higher Off-Net tariff to connect to a different network That said, a critical mass of people and wider network reach is needed for an operator to benefit from network externalities Since market structure differ between countries and regions, context matters when analysing network externalities	Sections 3.2.2 and 8.3.2 indicate that the impact of (negative) network externalities in telecommunications can be mitigated by policymakers through: Direct intervention (for example, price intervention using MTR), and Indirect intervention (incentivising the participation of smaller players through, for example, timely access to affordable (low) frequency spectrum
Volatility of macroeconomic conditions	This generally impacts various spheres of an economy This, in turn, impact all industries as, for example, unemployment result in low disposable income and low demand, access to forex may also become difficult due to a country's low receipts from international trade	Access to forex is critical to the telecommunications industry in Africa, which heavily reliant on FDI Furthermore, infrastructure is largely imported from overseas with payment dominated in US Dollars. Hence, the risk of default in times of economic downturn is high if the source of forex is curtailed by slow-down in the economy	Government can intervention through fiscal – lowering taxes and increasing government spending - and monetary policies – reducing interest rate to allow businesses to borrow more and increase in money supply by central banks However, such intervention has to be timely to match the occurrence of the event in order to avoid, for example, the aftermath of the market exit of Etisalat in Nigeria

3.2.2 Regulatory Instruments

According to Vedung (1998: 21), regulatory instruments are "*a set of techniques by which governmental authorities wield their power in attempting to ensure support and effect (or prevent) social change*". The social change in the context of this study is to effect widespread access to mobile telecommunications, which is fast becoming a useful socio-economic enabler for many across Africa (Collett, 2016; Jagun, Heeks, & Whalley, 2008). While a wide range of regulatory instruments as discussed in the literature (for example, Borras & Edquist, 2013; Burns & Richman, 2004; Mitchell, 1995) could be deployed by government to correct market failure (Bauer, 2010; Gillingham & Sweeney, 2010), this section will highlight those that are relevant to telecommunications and how they relate to the issues highlighted in Section 3.2.1. They include mandates, incentives and subsidies.

Mandate follows the traditional form of 'command-and-control' approach whereby a regulator can direct market actors to provide what is lacking in the marketplace (Bjornstad & Brown, 2004; Gillingham & Sweeney, 2010).). For example, if the good/service in question is a public good, which is essential to the socio-economic fabric of the society, a government may decide to mandate market actors to address the public need (Weimer & Vining, 2010). Examples of mandate instruments in telecommunications include rollout obligation[39] and price intervention via, for example, reduction in mobile termination rate (MTR). Rollout obligation arises from a situation where MNO are required, as part of their licence conditions, to commit to a predetermined level of network deployment in commercially unviable areas (Jain & Raghuram, 2010; Kalra & Borgohain, 2004; Naidoo, 2011). Failure to meet such a commitment will attract penalty such as fines and/or licence cancellation (Grabosky, 1995). Price intervention, on the other hand, involves the regulation of prices either to prevent large players from abusing their market position or to improve user affordability (Bjornstad & Brom, 2004; Intven, Oliver, & Sepulveda, 2000; May, 2012; Mitchell, 1995).

A recent example of this can be found in Malawi where the regulator[40] intervened in the market to reduce MTR from $4 to $2 per minute in order to make

[39] see Section 6.3.1

[40] The Malawi Communications Regulatory Authority (MACRA)

mobile tariff more affordable for end-users (TeleGeography, 2018d). The regulation of MTR is particularly useful for preventing large MNO from charging high access price (Off-Net tariff) that could stymie the expansion and operation of smaller players, limit them from benefiting from network externality and also impact on the end-users through affordability (Intven, Oliver, & Sepulveda, 2000). According to OECD (2012: 65), *"... access pricing is a key element of any interconnection regime..."* As such, pricing must reflect adequate incentive for a network provider to invest in infrastructure and for end-users to adopt what is being provided (OECD, 2012). To mitigate a market failure that results from network externality and affordability, a regulator may intervene in the market and regulate interconnection charges as discussed in Section 8.3.2.

While the use of mandate instruments offer a government the opportunity of achieving public objectives with minimum cost (Stiglitz, 2010), the need for enforcement, which requires human and financial resources, negates such argument (Panayotou, 2013). The use of mandate instruments can thus result in unintended consequences due to limited regulatory capacity (Grabosky, 1995). Secondly, while mandate instruments may require market actors to get on with the business of providing for the market, the coercive approach may leave market actors with the feeling of resentment and alienation (Ayling & Grabosky, 2006). The outcome of this may result in dysfunctional behaviour and a lack of cooperation from market actors, which will then detract from achieving a given objective (Sherman, 1993). Furthermore, although a mandate instrument like price intervention can be a useful tool for redistributing economic gains to deprived areas and attract smaller players to expand their networks by directing big players to lower interconnection charges, it can also be seen as 'discriminatory', particular in a liberalised market (Mitchell, 1995).

The use of **incentive** as a regulatory instrument is the polar opposite of mandate - instead of a 'command-and-control' approach, market actors are offered various incentives in order to encourage them to fill market gaps (Ayling & Grabosky, 2006; Grabosky, 1995; Gillingham & Sweeney, 2010). A relevant example to the current study is tax break (Panayotou, 2013: 52). Tax breaks are 'preferential' tax treatments that depart from the normal tax structure, which is offered to a certain group of taxpayers with the intention of mitigating market failures related to the externality of critical economic activities such as mobile telecommunications (Chen, 2015). The

deployment of telecommunications is inherently capital intensive and when high taxes are imposed on such a sector, it can distort further investments (Gillingham & Sweeney, 2010; Yardley, Adkins, & Woolfson, 2017). This is particularly true in emerging markets where private investors tend to incur more costs in setting up business operations due to general lack of infrastructure (Brodzka, 2013). To offset such cost, the government can offer tax breaks to encourage more investment (Mitchell, 1995; Oman, 2000).

One of the advantages of incentive is that since it is less coercive, it enhances 'freedom' in terms of the flexibility to accept or decline any offer made by the government compared to the rigidity associated with mandates (Gillingham & Sweeney, 2010; Grabosky, 1995). Secondly, market actors are more likely to perceive it as 'legitimate' as they feel less alienated compared to the use of mandatory instruments (Grabosky, 1995). Thirdly, the offer of incentives can help to mitigate market failure related to positive externality to the benefit of the wider society by compensating market actors for prohibitive transaction costs that cannot be fully recovered by market forces (Ai & Sappington, 2002; Chen, 2015). However, one of the criticisms of the use of incentives is that it may lead to a free rider problem where market actors who benefit from incentives may fail to reflect it their business operations (Grabosky, 1995). It then follows that for an incentive be effective, regulators need to figure out a way to enforce compliance to ensure that beneficiaries are held accountable to provide what they ought to for receiving incentives. In the absence of monitoring and compliance, the use of incentives will be susceptible to subversion and unscrupulous actions by market actors, which can then detract from the intended objective (Grabosky, 1995).

Subsidy is another example of non-mandatory regulatory instrument (Bjornstad & Brown, 2004; Gillingham & Sweeney, 2010). Although the term lacks an agreed definition, there appears to be an agreement that subsidy involves governments and part of the beneficiaries are the marginalised in the society (Olukoshin, 2004; WTO, 2006: IV & 48). In relation to the current study, subsidy refers to a situation where a government provides a certain form of direct financial assistance to market actors in order to improve the economic efficiency of serving marginalised areas (Cox, 2002; Solaymani, Kari, & Zakaria, 2013). This relates to people with low-income and a lack of access to basic public services, for example,

education, electricity, telecommunications and transportation (Solaymani, Kari, & Zakaria, 2013; WTO, 2006). Apart from offering direct financial assistance like the use of universal service fund (USF)[41], the government can also implement this instrument through cross-subsidies. This is a situation where some users are charged above costs margin for international or long distance services in order to subsidise the services of other users at a margin below costs for local or low access services (Clarke & Wallsten 2002; Xavier & Cave 1995)[42].

The aim here is to reduce the costs of network deployment and encourage operators to expand coverage beyond commercially viable areas. As such, one of the advantages of subsidy is that it could be combined with other mechanisms to help lower transaction costs and improve market efficiency for market actors (Bjornstad & Brom, 2004; Mitchell, 1995). However, the use of subsidies also has some shortcomings. Firstly, it encourages a dependency attitude on the part of market actors, which, in turn, delay market expansion and innovation (Grabosky, 1995). For example, MNO may delay coverage expansion to disadvantaged areas that may be commercially viable just to get a subsidy from USF. Secondly, with the existence of information asymmetry, a regulatory authority may end-up deploying USF to undeserving areas (WTO, 2006), as Section 3.2.1 has highlighted that market actors are typically well-informed than a regulator. This will then result in the misallocation of scarce resources and reduced public welfare (Allcott & Sunstein, 2015). Thirdly, the public sector in emerging markets are often found to lack a robust system of accountability, hence, subsidies are susceptible to political capture and corruption as those responsible for managing the process may abuse the system and misappropriate funds for personal use (WTO, 2006: 75). This is further highlighted in Section 5.2.6 where corruption is seen as one of the impediments to the implementation of USF in Africa. Furthermore, the opportunity cost of providing subsidy in a given sector may be an alternative forgone in another critical sector, for example, telecommunications versus healthcare or power. Hence, as will be seen later on in Section 6.3.4, it is argued that USF should be deployed as a tool that addresses multiple deprivations in disadvantaged areas and not just telecommunications.

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[41] See Section 3.3.3 for details

[42] See section 3.3.3 for details

Regardless of the choice of regulatory instrument, attention needs to be focused on the effectiveness and efficiency of the instrument (Gillingham & Sweeney, 2010). Effectiveness is the ability of a chosen instrument to produce the desired result of correcting market failure, and efficiency is the monetary and non-monetary costs of deploying a given instrument (Grabosky, 1995). This suggests that the accruing benefit of a given instrument should be compared with the cost of implementation in order to guide against poor policy design, implementation and, ultimately, policy failure (Gillingham & Sweeney, 2010; Trubnikov, 2017). It also highlights the need for an 'appropriate' balance between equity and efficiency in order to produce a regulatory instrument that maximises social gains and minimises transactions costs (Coglianese & Lazer, 2003). Although achieving such a balance could pose a challenge (Trubnikov, 2017), what is 'appropriate' within the context of this study would be a regulatory instrument that provides effectiveness in terms of bringing connectivity to the unconnected and accounts for efficiency to encourage private participation (Borras & Edquist, 2013; Gillingham & Sweeney, 2010). This is evident in the model proposed for closing the digital divide in Africa as will be seen in Section 8.1.

3.2.3 Criticisms of the theory of market failure

Although the theory of market failure provides the conceptual framework and guidelines, which policymakers rely on to address public equity and economic efficiency, various studies have identified some of its limitations (Wallis & Dollery, 1999; Zerbe & McCurdy, 1999). These limitations can be explained from two broad perspectives: public interest theory and the theory of economic regulation (Bonbright, 2005; Hantke-Domas, 2003; Posner, 1974; Stigler, 1971).

The central argument of the public interest theory is that government interventions arise in order to prevent or mitigate a lack of equity and efficiency in the marketplace in the interest of the wider society (Christensen, 2010; Picot & Wernick, 2007; Pigou, 1932; Posner, 1974). The theory of economic regulation, on the other hand, postulates that in the event of market failure, 'powerful' interests, typically market actors with large financial resources relative to consumers and regulators tend to influence regulatory intervention to maximise their benefits (Dassler, 2006; McChesney, 1997; Monti, 2003; Posner, 1974; Wenders, 1988). This underlines the argument that the industry is able to 'capture' the intervention process and make it

work for them to the detriment of the public, and the regulators who are mostly limited in their financial capacity (Hantke-Domas, 2003; Hertog, 2010; Picot & Wernick, 2007; Posner, 1974). As highlighted later in Section 5.3.2, this helps to explain why some rent-seeking MNO may try to influence regulatory authorities when it comes to issues like frequency spectrum allocation.

Since market failure is defined from the viewpoint of equity and economic efficiency, the limitations from both theories are reflected in the theory of market failure (Bergman, et al., 1998; Todorova, 2016). Firstly, the public interest theory presumes that in the event of market failure, government intervention is costless (Hantke-Domas, 2003; Posner, 1974). This indicates that it would cost governments little or nothing to implement market interventions. Juxtaposing this with telecommunications, this assumption appears inconsistent with evidence from practice where it has been proven that government needs human and financial resources to effectively run a regulator and with this comes a great deal of cost (Panayotou, 2013). For example, costs of setting up the office of the regulator either as an independent body or a unit within a government ministry, staffing and (re)training, legal and administrative, dealing with customer complaints and consultancy services where experts are engaged to assist with the complexity of telecommunications (Hansen, 2009; Xavier & Ypsilanti, 2008). The capacity of a regulator to carry out these activities is critical not least in policy formulation, implementation and policing (Bauer, 2013; Hantke-Domas, 2003; Posner, 1971; 1974).

Secondly, both theories assume that policymakers have access to sufficient and reliable information that is needed for informed decision-making in the event of tackling market failure (Wallis & Dollery, 1999; Hertog, 2010). Critics, however, disagree with this tenet arguing that in practice, more often than not, market actors tend to have access to better information while at best regulators imperfectly promote public interest with limited information (Estache & Wren-Lewis, 2009; Posner, 1971). Similarly, in the context of telecommunications, market actors like MNO are predisposed to better information about the market, hence, better informed if an area is economically viable or deserving government subsidy. This can be illustrated with the case of Lesotho where a lack of information has led the regulator to allocate subsidy to undeserving areas (see Section 5.4.2). Therefore, information asymmetry may lead policymakers to misallocate subsidies to less vulnerable areas and end up

subsidising MNO for deploying infrastructure to profitable areas (WTO, 2006). In countries where this happens, market failure, in terms of lack of mobile coverage, may persist as disadvantaged areas where subsidies are actually needed may be neglected.

Thirdly, critics also question the presupposition that the government can design public policy to address market failure in an 'altruistic' manner, which is, putting public interest ahead of self-interest (McChesney, 1997; Wenders, 1988). Downs (1957: 136) was particularly vocal on this front saying *"… what reason is there to believe that men who run the government would be motivated to maximise it"?* He further argued that the government, like any other agent, would discharge their duties to satisfy their self-interest, for example, money, prestige and power. Consequently, any attempt to formulate public policy to address market failure without accounting for the interests of those who are tasked with the administration and formulation of intervention would amount to little results. This helps to explain issues such as the undue political influence limiting the performance of USF as argued in Section 5.2.8.

In spite of these criticisms, the theory of market failure provides the intellectual debate for government intervention in the marketplace. It also provides the conceptual framework and guidelines that policymakers draw on to address market failure (Wallis & Dollery, 1999; Trubnikov, 2017). It is within this context that UAS of telecommunications has emerged as a policy framework for mitigating the digital divide of uneven mobile coverage.

3.3 Universal access and services

As a corollary of the discussion in Chapters 1 and 2, it is apparent that although liberalisation and competition were introduced following the 1997 WTO Basic Telecommunications Agreement to enable the market to provide widespread access to telecommunications, evidence abounds that this objective has not been achieved in Africa. This follows the estimation that that nearly half of the 1.2 billion people in Africa are believed to lack a mobile subscription (A4AI, 2017a; Collins, 2015; GSMA, 2016b; Manson, 2013). The market has, therefore, failed to meet the telecommunication needs of the wider society. Section 3.2.2 highlighted that in an effort to correct market failure, government can deploy various regulatory instruments. As such, governments across Africa have introduced UAS policy, specifically, the deployment of USF, which fits with the use of subsidy as a regulatory instrument to

tackle the market failure of uneven mobile coverage. This section will thus explore USF within the wider context of UAS policy by critically reviewing various issues in the literature, including its definition, origin and other UAS strategies. It will then conclude by presenting a summary of the conceptual framework for this study, clearly indicating how all the different elements within the framework fit together and reflect on the main research problems that this study aims to address.

3.3.1 Definition and origin of universal access and services

Various studies use different terms when it comes to UAS. For example, ITU (2013b) and Longstaff (1996) call it 'universal service', Oestmann and Dymond (2008) term it UAS, and Srinuan (2014) reference it as universal service obligation. A synthesis from these various sources indicates that they are all referring to the same issue but using different terminologies. This study adopts UAS, firstly, for the purpose of consistency and secondly, for the fact that in this form, one can clearly show that access to telecommunications is dependent on the availability of infrastructure and services to both individuals and the public. This will become clearer as this section progresses.

The advent of UAS could be traced back to the USA where Theodore Newton Vail first used the term in 1907 when he was the president of AT&T (Economides, 2004; Mueller, 1993). Although the likes of Blackman (1995) is of the opinion that it was Vail's initiative that led to the widespread of telephone penetration in the USA, Crandall and Waverman (2000) and Muller (1993) disagree. They argued that Vail's effort only made Bell a monopoly as the majority of end-users were now connected to its network. Perhaps this is one of the reasons why Hudson (2006) linked the origin of the term to an industrial strategy, that is, a policy that favoured the industry rather than the public. While it is not within the scope of this research to substantiate the difference in opinion of these authors, the origin of UAS, which predates mobile technology, appears not to be in dispute. Having established this, the next step is to explore the meaning of UAS.

As with the terminology, it is unsurprising there is a general lack of consensus regarding the definition of UAS with varying views from both academics and practitioners (Alleman, Rappoport, & Banerjee, 2010). For example, Blackman (1995: 171) noted that "…*it* [UAS] *looks to be coated in myth, a slippery and ideological*

concept manipulated by different parties to support their own case for special treatment." Jain and Das (2001) and Milne (1998) thus stated that the composition of UAS varies from country to country depending on economic conditions and the level of telecommunications development. Blackman (1995) concluded that the UAS is a dynamic concept that needs to be viewed through the lens of a particular country's stage of development, economic, political, and social objectives. The definition of UAS is, therefore, not straightforward (Xavier & Cave, 1995). Nonetheless, some of the definitions contained in the literature and practices from across Africa are presented in Table 4.

Table 4: Definition of UAS: views from the literature and practices across Africa

Source	Definition
Literature	
Muller (1993: 353)	"In its common modern construction, universal telephone service means reaching every member of society, no matter how remote or poor."
Nett (1998: 661)	"Universal service in telecommunications comprises that a minimum standard of services has to be supplied to everybody at an affordable price."
Oestmann and Dymond (2008: 1)	"Universal service (US) refers to service at the individual or household level, e.g., typically a telephone in each home. Universal access (UA) refers to a publicly shared level of service, e.g., through public payphones or Internet telecentres. However, in more and more countries, UA and US apply at the same time, and it, therefore, makes also sense to use the generic term universal access and service (UAS)".
Practice in Africa	
ANRT (2017)	In Morocco, universal service is defined as "… a mechanism to allow, in the long term, access to the entire Moroccan population to basic telecommunication services: telephony and internet".
USPF (2015)	Universal service in Nigeria is seen as the promotion of "…the achievement of national policy goals for universal access and universal service to information and communication technologies (ICTs) in rural, un-served and under-served areas in Nigeria".
UCSFA (2014)	Tanzania defines universal service as "a minimum set of communications services of a specified quality which is available to all users independent of their geographical location, and in the light of specific national conditions, at an affordable price."
TRASA[43] (2002: 12)	TRASA defined universal service as the "affordable and equitable access by everyone to information and communications networks".

Table 4 illustrates the argument made earlier that various sources use different terminologies when it comes to UAS. Xavier (2008), who made a distinction between UA and US further underlines this position. Xavier stated that though UA and US are closely related and used interchangeably, they mean different things. Xavier defined US as the provision of telecommunication services to every household regardless of their locations and UA as a guarantee to telecommunication services on a shared basis. Feijoo and Milne (2008) also corroborated this distinction as they defined US as the

[43] The Telecommunications Regulatory Association of Southern Africa (TRASA) is a regional telecommunications body formed by 15 member states of Southern African Development Community (SADC, 2012).

provision of telecommunication services at the individual or household level and UA as the provision of telecommunication services on a public share basis like public payphones or telecentres.

From a synthesis of the various definitions presented above, one can argue that UAS is a government intervention targeted at ensuring widespread access to telecommunications for individuals and the public. Furthermore, although the definitions provided echoes varied views from the literature and practices across Africa as illustrated by Table 4, some commonalities can be observed. These include availability, affordability and accessibility. On the back of reviewing the contributions from various literature, Feijoo and Milne (2008) asserted that from the late 1980s, these three elements have been the main foundations of UAS. ITU (2013b) and Oestmann and Dymond (2008) alluded to this by stating that these three elements constitute the underlying principles of a 'good' UAS policy. Since these principles may have different meanings, depending on influences like economic conditions, developments within the telecommunications sector, and political will (Milne, 1998), this study adopts the definition of ITU (2013b):

- Availability implies that the level and QoS should be the same for everybody regardless of where they live or work, at any time across geographies;
- Affordability implies the ability of everybody to afford or pay for telecommunication services, regardless of their locations or income level; and
- Accessibility implies that everyone, without distinction of race, sex, religion, etc., should have access to telephone services without any discrimination such as price and QoS.

In the light of this reasoning, one could argue that, regardless of the different definitions adopted by various countries, a viable UAS policy should reflect these three principles in order to close the digital divide (Oestmann & Dymond, 2008, ITU 2013b). In addition to these three long-standing principles, this study makes a case for an extension that includes **assessment** and **awareness**. The basis for this argument is anchored on the fact that the origin of UAS predates mobile technology and when these three traditional principles were conceived around 1907, technology was not as advanced as it is now (Batura, 2017; Mueller, 1993). One of the implications for technological advancement is that, the availability and accessibility of physical

infrastructure are critical for UAS but not sufficient in terms of helping end-users to experience the full benefits of digital technology (Shenglin et al., 2017). As such, there is need to look beyond physical infrastructure and affordable access to network and build capacity to promote technological knowledge and a host of content because as technology advances, so do end-users needs and the knowledge required to explore such technology (Nsengimana, Kende, & Rose, 2015). For example, the emergence of smartphones and various mobile applications would mean that the information needs of the society are constantly and rapidly changing (Batura, 2016). These changes are also dynamic in their impact on infrastructure as modern communication networks are increasingly becoming IP-based, enabling small and big players to bundle-up services like voice, video, and data in a single package for end-users (Xavier, 2008).

What results from this process is the convergence of telecommunication services that are constantly and rapidly changing (Cramer, 2015; Hudson, 2006). Consequently, the perception of what constitutes a relevant telecommunication need is evolving and for policy to be relevant and effective, regular assessment of needs is arguably required (Batura, 2016; Okerlund, Parsons, & Hulterstrom, 1995). Assessment would then help policymakers to identify relevant gaps in telecommunication and facilitate the formulation of more effective and efficient policy (Crosby, 1996; Mamabolo, 2016b; Thomas & Grindle, 1990).

This study also makes a case for awareness in the sense that it is insufficient to deploy network without informing people about its benefits and how to use mobile devices as they evolve (Ameen & Willis, 2016; van Dijk, 1999). Awareness thus highlights the importance of digital education and training, which is critical to stimulate mobile adoption, generate online traffic and increase ARPU[44] for MNO (Msimang, 2012; Nsengimana, Kende, & Rose, 2015; van Dijk, 2003). Therefore, the definition of **access** to telecommunications in this study refers to the provision of mobile telecommunications in a manner that encompasses availability, accessibility, affordability, assessment and awareness – in the sense that where any of these principles are missing, UAS policy cannot fully address the digital divide. See Section 6.2.1 for more insight.

[44] Average revenue per user

From the definitions presented in Table 4, particularly the views from various regulators in Africa, it appears that some policymakers are aware of the advancement of technology and the need to capture this in UAS policy. However, some of these definitions appear rather ambiguous in terms of setting clear targets and/or incomplete in terms reflecting the principles of UAS discussed above. For example, although most countries target UAS at 'unserved' and 'underserved' areas, no specification is provided as to what this constitutes with a few exceptions like Egypt and Ghana. Egypt explicitly states that such areas shall include regions with at least 300 inhabitants (ITU, 2013b). Ghana, on the other hand, defined unserved areas as locations with 'no communications service' and underserved areas as communities with only '2G services' or 'poor 3G services' (NCA, 2017). UAS definition in certain countries like Nigeria and Malawi also covers 'ICT' without explicitly stating what ICT is limited to (MACRA, 2013; USPF, 2015). In practice, ICT could cover a host of different services, technologies and networks, and to imply that UAS in such countries covers unlimited scope is arguably unattainable.

3.3.2 Strategies for funding universal access and services

Contrary to the assumption by the public interest perspective of market failure, that government intervention is costless (Section 3.2.3), evidence from practice suggests that government need resources to, among other things, fund the subsidisation of telecommunications infrastructure in disadvantaged areas (Xavier & Cave, 1995). This raises the question of how and who pays for such subsidy?

Prior to the introduction of competition, the strategy for executing UAS was **Cross Subsidy** (Bhuiyan, 2004; Kaserman, Mayo, & Flynn, 1990; Mitchell, 1995). Cross-subsidy involves a complex process where, for example, some users are charged above costs margin for international or long-distance services in order to subsidise the services of other users at a margin below costs for local or low access services (Clarke & Wallsten 2002; Longstaff, 1996; Xavier & Cave 1995). This cost-shifting practice can be illustrated with the case of the USA where, for example, in 1995, the average single-line rate for businesses was $41.77 compared to $19.54 for residential users (Parsons, 1998). Apart from businesses cross-subsidising residential users, long-distance services also attracted higher rates compared to local telephone rates (Majumdar, 2011; Palmer, 1992).

One of the problems associated with this mechanism, apart from the fact that it is more applicable under a monopolistic market, is ineffectiveness in the sense that it can distort consumption and investment decisions in the process of trying to separate price from cost (Clarke & Wallsten 2002; Majumdar, 2011). Critics also see it as a non-transparent mechanism due to the difficulty in differentiating between those who receive a subsidy and those who actually pay for it (Clarke & Wallsten, 2002; Majumdar, 2011; Parsons, 1998). Hatta (2008) further argued against this method of funding because it comes at a cost in terms of higher prices for certain customers. Hence, as the traditional means of extending coverage to disadvantaged areas, it gradually became inoperable with the advancement of liberalisation, as MNO who relied on subsidising one service with another, now face competition from rivals who can offer lower prices for both local and long-distance services (Hudson, 2006).

Universal Service Fund (USF) is another UAS funding strategy suggested by Blackman (1995) and Clarke and Wallsten (2002). This funding mechanism is consistent with a liberalised market where competing MNO and other service providers are required to contribute a proportion of their annual revenue into a pool of fund for subsidising network deployment in disadvantaged areas (Blackman, 1995). The idea behind such initiative is that MNO will not extend service to uneconomically viable locations without financial assistance to help lower their transaction costs (GSMA, 2014). Although USF is consistent with the deployment of subsidy as a regulatory instrument (Section 3.2.2), it also has the attribute of a mandatory instrument since the payment of USF levies by MNO are compulsory. This makes USF a hybrid regulatory instrument, the implementation of which could be complex as it reflects the characteristics and limitations of both mandatory and subsidy instruments discussed in Section 3.2.2.

In a study conducted by GSMA (2014), 64 countries were surveyed and a key finding was that USF as a UAS strategy appears to be inefficient and ineffective, as over $11 billion was lying idle without disbursement across countries including Gabon and Zimbabwe. Similarly, although USF was first established in Latin America in the mid-1990s (Hudson, 2010), over 30 countries in Africa have established USF as their UAS strategy to bridge coverage gaps. Its impact across the continent raises more questions than answers in terms of promoting widespread access to telecommunications. Section 3.4 examines this in detail.

UAS can also be executed through **Auctions** (Blackman 1995; Clarke & Wallsten, 2002; Nett 1998). Hatta (2008) referred to this as a competitive process of issuing licences with conditions specifying a given level of geographical or population coverage over a period of time. Operators participate in this process through a transparent and open competitive bidding process where the winner of the bid becomes the UAS provider for specific locations (Nett, 1998; Jain & Das, 2001). The successful bidder is expected to meet certain conditions like a specified standard of QoS and competitive tariffs that reflect the benefit of whatever support received from the government (Blackman, 1995).

The award of $18.3 million contract to Tunisie Telecom to deploy 3G and 4G network to unserved areas with 180,000 people across 112 districts in Tunisia helps to illustrate this strategy (TeleGeography, 2017f). The use of auctions has also been successfully implemented in countries like New Zealand, Australia, and Chile (Jain & Das, 2001). One of its advantages is that it can help to facilitate market entry and exploit MNO cost and revenue valuations as against imposing an external costing method by the regulator (Blackman, 1995). Regulators can then devise a method for geographical allocations as well as the monitoring and enforcement of performances against a set of determined conditions.

'**Pay or Play'** strategy is another mechanism highlighted by Blackman (1995). In this case, an operator can either pay to support UAS by contributing to USF or undertake the process of improving UAS in a given location by itself (Blackman, 1995; ITU, 2013b). The strategy thus has the hallmark of a mandatory and non-mandatory instrument – in the sense that when an operator opts for the pay option, it is mandatory to contribute to the fund and when it chooses to undertake the process alone, USF contribution is not compulsory (ITU, 2013b). Although one of the advantages of this strategy is that operators are more involved in the process of improving UAS as they can choose between two alternatives, but there is also the dangers of excluding certain locations, especially areas with low population density and poor supporting infrastructure such as roads and electricity (Dorward, 2013).

It could then argue that if the choice of selecting locations is left exclusively to the discretion of MNO, achieving widespread access may not be possible, especially in a continent like Africa where there is a considerable level of lack of supporting infrastructure. To mitigate this in a country like Morocco where pay or play is

practiced, operators that are willing to undertake the process themselves are required to propose their projects and then submit proposals to CGSUT[45] for review and approval (ANRT, 2017; Dorward, 2013). Morocco and Togo are two examples in Africa where the pay or play strategy is being practiced with a mixed outcome in terms of mobile penetration rate – 125% and 63 % for 2016 respectively (see Figure 4, Section 2.2).

Hatta (2008) and Jain and Das (2001) suggested the use of **Licencing conditions** as an alternative to USF. This involves a situation where issuance/renewal of licences and frequency spectrum are bundled with buildout requirements that encompass UAS (Hatta 2008; Jain & Das 2001). Indian and the Philippines are some of the countries where this strategy has been implemented as a given level of rural coverage are included as part of the licencing conditions of MNO. For example, 10% of unserved rural areas was imposed as part of licence conditions for operators in India while licences for viable and unviable areas were bundled for operators in the Philippines (Jain & Das, 2001). Brazil also adopted this strategy in 2007 by requiring the winners of 3G licences in profitable areas like Sao Paulo in the south to deploy network to unprofitable areas in the north, which led to coverage expansion for over 5,000 communities without recourse to USF (GSMA, 2013b). Since these countries share similar socio-economic conditions with African countries as emerging markets, it may be worthwhile for governments in Africa to consider this strategy by informing MNO from the outset what level of investment they need to earmark for meeting UAS as part of their licensing conditions. This strategy falls under the purview of a mandatory instrument (Section 3.2.2).

Regardless of the strategy adopted, Xavier and Cave (1995) asserted that the viability of any choice must fulfill certain critical criteria - the process must be transparent and equitable in terms of including relevant stakeholders in the discussion process and the selection of projects. Policymakers should ensure that there is some level of flexibility in terms of reviewing the terms of reference as the situation may warrant. The issue of cost-effectiveness and project efficiency were also raised in

[45] The Universal Telecommunications Services Management Committee (CGSUT)

terms of deploying the 'right' technology in accordance with the needs of users, the physical conditions of a given area and the stage of network development.

3.3.3 Stages of universal access and services

The study of Milne (1998) put forward a unified framework termed the *'five stages of network development'*, which a nation can implement to attain a desirable result for UAS. In the process, a nation may then identify with any of the stages to reduce the number of choices they need to consider. A brief overview of these five stages is contained in Table 5.

Table 5 provides a simplified yet broad view on how a country could develop its telecommunications sector over a given period by going from the rudimentary stage of network establishment to a full modern telecommunications infrastructure stage where a plethora of services is readily available to the wider society. While the framework draws largely from the historical development of various developed economies, issues such as technological changes and liberalisation may enable some developing economies to combine or jump certain stages due to overlaps (Milne, 1998). Although the proposed five stages have their differences, the following common elements cut across all the stages:

- UAS is desirable for social and/or political reasons which include the notion of equity
- The commercial viability of UAS is most likely not achievable
- The definition of UAS will keep changing with the evolution of technology and the needs of the society
- The issue of 'basic' telecommunications services encompasses a well-established and relatively cheap service to all people
- Adequate QoS is defined and understood
- Affordability of services for end-users if critical for adoption

While the above elements may hold true, the issue of the non-commercial viability of UAS, in terms of a lack of profitability for operators, is debatable when one considers the impact of externality (Section 3.3.2). A case in hand is Burundi where almost 90% of its more than 10 million population reside in the rural areas (World Bank, 2017). If mobile coverage is extended to these people, the externality effect of those in rural areas communicating with their urban counterparts presents a situation where UAS can be profitable as operators will have access to a bigger market (ICTA, 2004). It then follows that a commercially 'unviable' area today may become

a commercially ‘viable’ area tomorrow as disadvantaged locations are connected and continue to interact with served areas (Blackman, 1995). Hence, UAS can transform from being an obligation to an opportunity in the long run.

One of the implications of the stages outlined in Table 5 for Africa is that countries should structure their UAS policies according to the level of their socio-economic development and market liberalisation. For example, UAS that fits for say Kenya may not necessarily work for Burundi and vice-versa as these two countries are on different levels when it comes to indices such as GDP, teledensity, market constraints, and network developments. Instead of the practice of countries seemingly copying each other’s framework as indicated by Muriu (2002) in his analysis of Kenya and Ghana, policymakers should engage their respective industries and collectively decide a somewhat bespoke UAS strategy. Although basic building blocks, for example, the five principles of UAS proposed earlier in Section 3.3.1, having an open discussion with various stakeholder and a transparent process for projects selection can be the same (Xavier & Cave, 1995). This can then lead to the establishment of a more cost-effective and efficient UAS framework in line with the recommendations in Table 5.

Table 5: Five Stages of UAS Policy

Characteristics	**Stage One**	**Stage Two**	**Stage Three**	**Stage Four**	**Stage Five**
	Network establishment	Wide geographic reach	Mass-market take-up	Network completion	Service to individuals
Teledensity	0-5 per 100	1-20 per 100	15-40 per 100	35-60 per 100	>50 per 100
GDP range	Low income	Lower middle income	Upper middle income	High income	High income
Business take-up	0-30%	20-80%	70-100%	100%	100%
Household take-up	0-10%	5-30%	20-85%	75-100%	100%
Typical phone company culture	Entrepreneurial	Administrative (government dept.)	Operational (huge workforce)	Commercial (privatised)	Competitive
Typical management preoccupations	Large-scale capital investment in new technology	Public service and technical network improvement	Growing the network	Growing call revenue (marketing)	Profitability
Main constraints to network expansion	Investment funds, the right technology and skills	Limited demand as a result of high tariff and the use of alternatives	Manpower for plant installation in meeting mass demand (waiting list)	Affordability of services to poorer households and cultural acceptability of telephony	Market appeal
Typical public policy (telecom)	Investment incentives	Government control (due to national security and economy) and geographical uniform charges	Installation and rental charges kept low in order to stimulate service demand	Network completion and cost-oriented tariffs	Free and fair competition

Characteristics	Stage One	Stage Two	Stage Three	Stage Four	Stage Five
Universal service goal type	Technological (acquisition of new technology)	Geographical (maintain regional parity)	Economical (stimulation of the economy)	Social (achieve political cohesion)	Libertarian (individual right to communicate)
Examples of universal services goals	Long distance services linking all major centres and public telephones were necessary	The availability of telephone services in all population centres and widespread usage of telephony in business	Widespread residential take-up of telephony and meeting all reasonable demands for telecoms	Telephone affordability to all and adapting telephones to special needs	Everyone can meet basic communication needs and public access to advanced services (esp. education and health)
Typical market research focus	Payphone rates and locations	Main small business requirement	Main household requirements	Rural, disabled, and low-income needs	Needs created by new services e.g. mobility internet
Typical public policy measures for universal service	License conditions on network rollout	Profitable licences s.t. un-profitable obligations	Control speed of price rebalancing	Targeted subsidies	Identify and meet non-market demand

Source: Modified from Milne (1998: 776).

3.3.4 The future of universal access and services

According to Dordick (1990, p. 223) *"Societies are not static, nor are the policies they deploy to meet their needs"*. This is indicative of the central argument in Section 3.3.3 that UAS policy should evolve along with socio-economic and technological development. Similarly, Xavier (1997) suggests that factors such as competition, technological convergence, and advancement in networks would continue to influence the extent and nature of UAS (Xavier, 1997). Hence, UAS scholars have called for a re-think of the concept in order to continuously reflect the changes that are sweeping through the information society (Feijoo & Milne 2008; Hatta 2008; Xavier 2008). Xavier (2008) examined the issue of advancement in technology, which he said is creating a convergence of various activities leading to a situation where a single platform can now provide voice, data and other services. This underlines the argument in Section 2.2 that the technological developments such as those offered by mobile have enabled countries across Africa to leapfrog years of neglect by state monopolies and their fixed network (Economist, 2008; World Bank, 2017). Xavier (2008) then argued for the scope of UAS to be extended beyond the basic service of voice penetration to other emerging services.

Xavier (2008) draws four conclusions. Firstly, that the traditional scope of UAS should not be downgraded or eroded as the deployment of IP-enabled networks may facilitate coverage faster in some areas than others. This is necessary in order not to create a new digital divide and deny people the basic access being promoted by UAS. Secondly, the need for countries to address the issue of what support is required to encourage more broadband access since this is a catalyst to accessing services in an emerging convergence environment. Each country needs to consider this in their own context since they all have different capacity, political and social factors. Thirdly, end-users should be empowered with open-access conditions to switch between operators of their choice. Lastly, as IP-enabled networks continue to spread, measures should be taken by authorities and all concerned to ensure affordability of such services to end-users as well as providing special assistance to disabled and other marginalised people in the society in accessing relevant telecommunication services.

Drawing on the analysis recounted so far, telecommunications development in African countries may not be expected to be at par with the developed economies given their late liberalisation, and the various stages of network development outlined

in Table 5. However, one could argue that as policymakers and other key actors across Africa considers the future of UAS, there is need for such deliberation to encompass 'basic' telecommunication services that include voice and data irrespective of any barrier as access to such services is fast becoming a critical socio-economic enabler for many across Africa (Collett, 2016; Donner, 2004; Molony, 2006).

3.4 Universal service funds in Africa

Governments around the world implement UAS through different strategies (Thai & Falch, 2017) and Section 3.3 highlighted that over 30 African countries have established USF as their UAS strategy. This section will thus investigate into USF by looking at its origin and objective, theoretical and practical definitions with respect to Africa, explore how USF is generated, administered and distributed. This section will also highlight the current state of USF in Africa by drawing on country examples from across Africa as well as other parts of the world including Latin America where USF originated from for the purpose of comparison.

3.4.1 Origin, objective and definition of USF

USF was first established in Latin America in the mid-1990s (Hudson, 2010). Contrary to Hatta (2008) who argued that market intervention through UAS is unnecessary since competition will address market inefficiencies, USF was established in recognition of the fact that the market has failed to meet the telecommunication needs of the wider society (Msimang, 2012; Oestmann & Dymond, 2008). This is particularly relevant for those at the margins whose participation in the information society may be hampered by barriers such as geographical location and income level as examined in Section 2.4. For example, as with other Latin American countries, market liberalisation increased the levels of mobile penetration in Colombia between 1995 and 2004, but suburban and rural areas were marginalised (Stern & Townsend, 2006). This prompted the establishment of the first USF in Colombia in 1994 to subsidise the expansion of telecommunications to disadvantaged areas (Hudson, 2010). USF in Colombia collected over $400 million via a 5% levy and disbursed over $160 million between 1994 to 2006, installing rural payphones in 9000 communities with over 5 million people (Hudson, 2010; Stern & Townsend, 2006).

A synthesis of various studies on USF (for example, GSMA, 2014; ITU, 2013b; Sepulveda, 2010; Stern & Townsend, 2006) defines USF as a fund established

by policymakers to provide financial subsidy to MNO in order to facilitate the deployment of networks in economically unattractive areas with the intention of achieving UAS. The definitions from practice are also similar. For example, South Africa, which was the first country to establish USF in Africa, defined USF as a fund created to finance projects and programmes that facilitate UAS to 'ICTs' for everyone in South Africa (Hudson, 2010; USAASA, 2017). Tanzania described USF as a UAS mechanism created to ensure the availability of 'communication services' in disadvantaged areas for the purpose of promoting socio-economic development (UCSAF, 2014). Elsewhere in Egypt, USF is viewed as a funding mechanism created to ease the provision of affordable 'basic' telecommunication services for all citizens, particularly those in 'economically non-feasible' regions of the country (MCIT, 2017).

Drawing on the views of both practitioners and studies (such as GSMA, 2014; ITU, 2013b; Sepulveda, 2010; Stern & Townsend, 2006), it came to the fore that the main objective for establishing USF in Africa (in broad terms) is to compensate MNO and other service providers for extending coverage to disadvantaged areas. While the definition and objective of USF appear to be broadly the same between countries, there are differences when it comes to how USF is established, its legal framework, funding, administration and disbursement. These issues are addressed in the following sections.

3.4.2 Establishment of USF

As with other development programmes, the establishment of USF usually begins with political discussions at the national level through either cabinet and legislative debates or a unilateral decision under a non-democratic system of government (Dorward, 2013). This results in passing of parliamentary law or decree that creates USF and drive the legal and regulatory framework for its implementation (ICTA, 2004; Oestmann & Dymond, 2008). Such process is usually significant in light of giving USF the authority and credibility that stems from national leadership to ensure an effective policy implementation (ICTA, 2004). While the majority of countries from other parts of the world have established USF through an act of parliament – for example, Telecommunications Act (amended) of 1997 in the USA and the Federal Telecommunications Law of 1995 for Mexico, countries in Africa have created USF

through parliamentary laws and decrees. For example, USF in South Africa[46] was created under the Electronic Communications Act of 2005 with the mandate to offer financial subsidies to:

- Assist 'needy' people with the cost of providing and using broadcasting and electronic communications services;
- Finance the construction and expansion of electronic communications network in under-serviced areas;
- Procure broadcasting and electronic communication network services and access for educational institutions; and
- Offer training and payment of allowances for people working where access to electronic communications network can be obtained (USAASA, 2017).

In contrast, USF in Algeria[47] was established by Decree Number 03-232 and amended by Law 55-01 of 2004 with the following mandates:

- The provision of 'adequate' telephone services to remote and low-income locations;
- The provision of public payphones
- The provision of access to public and free emergency call and information directory
- The scope was widened in 2009 to include access to the Internet and 'new' technologies like broadband (APRT, 2003; Dorward, 2013).

The majority of USF in Africa become operative several years after their establishment while some remaining inactive but continues to receive funds. For example, Ivory Coast established USF in 1998 but began operation in 2006 while DR Congo created USF in 2002 but remains inactive until now even when it had over $63 million in 2008 (ITU, 2013b; Sepulveda, 2010). While the delay in operation stems from the time lag between fund collection, project identification and disbursement, inactive funds are caused by factors such as a lack of political will from government to utilise the funds and a lack of technical skills to deploy USF (see Section 5.2). Since telecommunication services are moving targets driven by technological changes, the

[46] Universal Service and Access Fund (USAF)

[47] Universal Telecommunication Service Fund (FSUT)

underlying legal and regulatory framework of USF should also be flexible to meet the changing needs of the society (Dorward, 2013; ITU; 2013b). While countries like Ghana and Rwanda reflect examples in Africa where USF framework have been transformative in terms of broadening its scope to support rural broadband and one laptop per child initiative, others like Cameroon and Gabon appears to be stagnant with the provision of fixed line rooted in their frameworks even when mobile has become the default means of communication in Africa (Arakpogun, Wanjiru, & Whalley, 2017; Curwen & Whalley, 2018; GSMA, 2013a).

3.4.3 Funding USF

Although the sources of funding USF varies between countries, levies collected as a percentage of operator revenues appear to be more popular. Such levies range from 0.04% in Estonia to 3% in Ukraine, 1% in Ecuador to 5% in Columbia, and 0.75% in Indonesia to 6% in Malaysia (Hudson, 2010; Intelecon, 2009; OECD, 2014). These levies are usually collected from both fixed and mobile operators with a few exceptions like Peru where cable TV providers are required to contribute the 1% USF levy and Nepal where ISPs also contribute 2% along with other fixed and mobile operators (Intelecon, 2009). Apart from operator levies, countries such as Chile, Guatemala and Paraguay fund USF through government budgets and the World Bank also support USF in countries like Chile and Mongolia (Hudson, 2010; Intelecon, 2009). Hudson (2010) refers to such governments and international contributions as seed funding[48]. On a different note, USF is funded in Jamaica via levies on incoming international traffic with $0.02 on mobile termination and $0.03 on fixed termination (Intelecon, 2009).

When it comes to Africa, USF is also largely funded through levies, albeit contributed by MNO as a percentage of their annual revenues. For example, USF is funded via a 1% MNO levy in Ghana and, 2% in Rwanda and Zimbabwe (GIFEC, 2013; Intelecon, 2009; POTRAZ, 2015). Arakpogun, Wanjiru, & Whalley (2017) found that over 30 countries across Africa fund USF through varying degrees of levies collected from MNO as indicated in Figure 5.

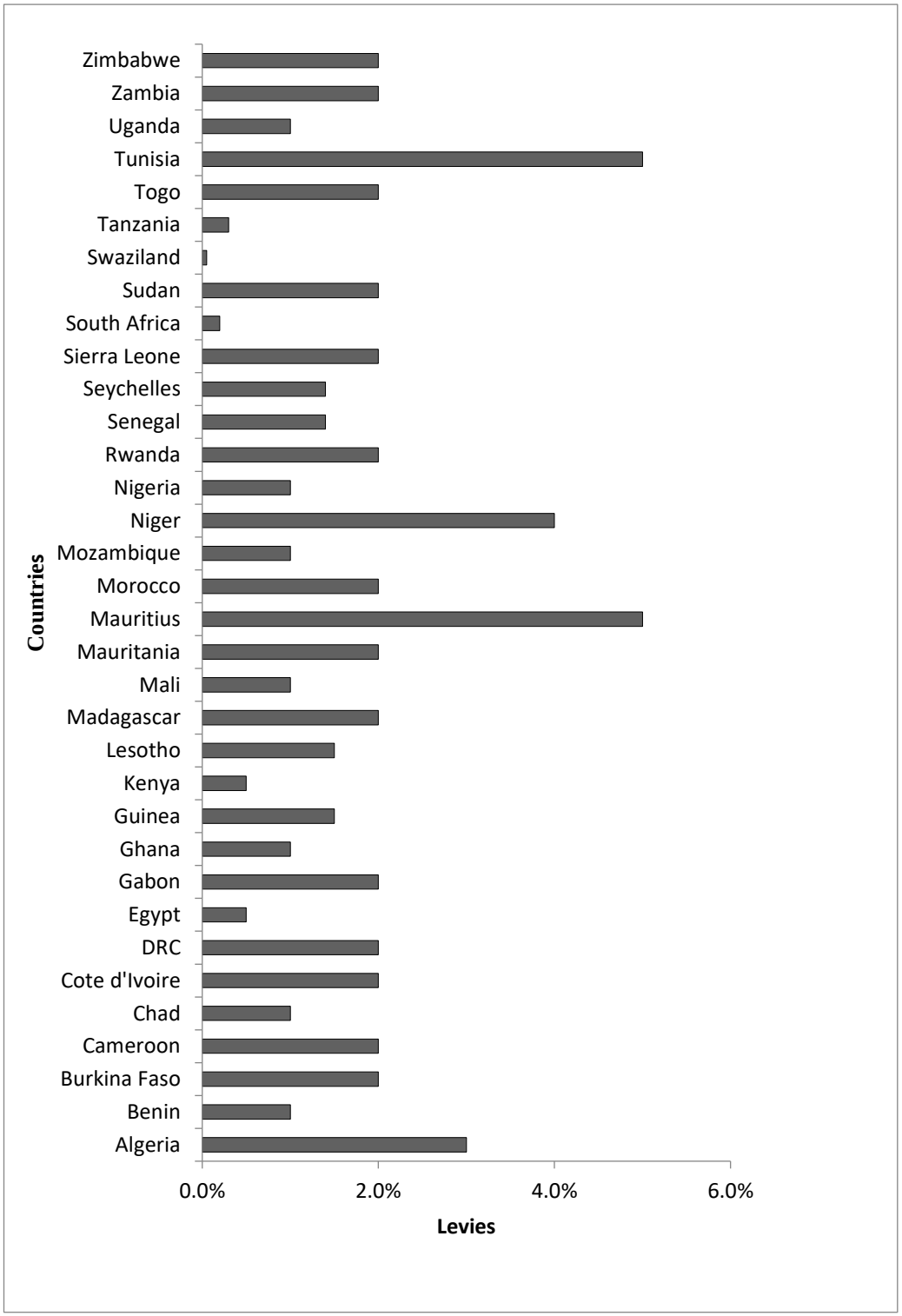
[48] The mechanism of contributing to UAS in a liberalised market, without direct involvement in the ownership or management of targeted projects.

Figure 5 indicates that USF levy varies across Africa. While Mauritius and Tunisia are highest with 5%, Swaziland has the lowest rate at 0.1%. Other countries are somewhere between 0.2% in South Africa, 0.5% in Kenya and 1% in Nigeria. Although Morocco and Togo fund USF through a 2% USF level, the pay or play strategy highlighted in Section 3.3.2 is also operational. For example, in Morocco, an MNO can contribute to UAS in two ways: either by paying 2% USF levy or by constructing networks in deprived areas identified by the CGSUT[49] (ANRT, 2017). Apart from levies, USF is also funded through parliamentary allocations and grants from the World Bank in certain countries such as Burkina Faso, Ghana, Madagascar, Tanzania and Uganda. Due to the lack of financial reporting associated with most USF, the actual amounts of these contributions are not publicly available, except for Uganda, where about $15.1 million funding has been received from the World Bank from 2002-2014 (UCC, 2015). IFC (2016) also highlighted that from 2007-2015, the World Bank provided financial and technical assistance to USF projects in Madagascar across 660 rural communities.

To determine the 'sufficient' amount of levy that will match actual project funding, it is good practice to conduct market research and determine what project needs to be funded, the scale of the project and the total estimated costs (ICTA, 2004; Stern & Townsend, 2006). A USF levy is then set according to such analysis, however, studies (for example, GSMA, 2013b; ICTA, 2004; Stern & Townsend, 2006) have found that countries across Africa tend to fix arbitrary USF levies with the effect that more funds are collected with fewer projects to execute while some countries are unable to quickly identify projects for funds collected. This has led to the accumulation of idle funds, which is over $400 million across 20 African countries. It should be stated here that idle funds are not peculiar to African countries alone as this is also evident in other parts of the world, for example, USF in Brazil has over $4.5 billion while India has $3.9 billion (GSMA, 2013b; ITU, 2013b).

[49] Universal Service Telecommunications Management Committee

Figure 5: USF levies across 34 African countries in 2016



Source: Arakpogun, Wanjiru, and Whalley (2017, p.4)

3.4.4 Administration and disbursement of USF

The administration of USF in various countries can be broadly classified into three categories following respective underlying legal and regulatory frameworks. For example, while countries like India, Peru and Vietnam administer USF through their ICT ministries, Chile, Romania and Saudi Arabia administer USF through their sector regulators, and others like Pakistan and the USA have established separate independent agencies to manage USF (Intelecon, 2009; Thai, Falch, & Williams, 2018; USAC, 2018). Regardless of the method of administration, an interesting issue among countries is the level of 'independence' accorded to various administrators – where independence means the level of autonomy an administrator has over USF without the encumbrance of government (Dorward, 2013; ICTA, 2004). Therefore, autonomy is a key driver of how dependent or independent the management of a fund is (Hudson, 210).

It is generally believed that fund administrators in countries with independent regulators and agencies tend to have more autonomy with less government interference and, by extension, more transparency and accountability relative to USF managed by government ministries (Intelecon, 2009; Hudson, 2010). However, there is evidence to suggest that this may not always be the case as government interference could be a threat to USF regardless of how it is administered. For example, although USF in Pakistan is an independent agency headed by a chief executive officer (CEO) and an independent board with private and public representation, the Prime Minister took over the control of the fund following the dismissal of the CEO in 2013 (GSMA, 2013b; ITU, 2013b; Khan & Butt, 2011). The Minister of Finance in Indonesia has also interfered in USF in the country by insisting on reallocating the funds to another purpose rather than providing subsidies for UAS (GSMA, 2013b).

USF across Africa are either administered 'independently' by a separate entity or dependently by a department situated within the relevant ministry or sector regulator. For example, USF in Ghana, which was created in 2008 under the Electronic Communications Act 775, is administered independently by GIFEC[50] with Abraham Kofi Asante currently acting as its administrator (GIFEC, 2017; ITU, 2013b). The

[50] Ghana Investment Fund for Electronic Communications (GIFEC)

responsibilities of GIFEC include the design, implementation, monitoring and evaluation of USF in line with the Electronic Communications Act 775 of facilitating UAS to unserved and underserved communities (GIFEC, 2017). On the other hand, USF in Morocco, established by the Finance Act of 2005, is administered by a management group called CGSUT[51], which is appointed by the government and situated within the sector regulator (ANRT, 2017). Since Morocco practices the pay or play strategy, MNO who want to serve a disadvantaged area without contributing to USF are required to propose their projects and then submit proposals to CGSUT for review and approval (ANRT, 2017; Dorward, 2013). CGSUT is also responsible for disbursing USF among MNO who choose the pay option and contribute the 2% USF levy.

This leads to the issues of project identification and disbursement of USF. It is apparent from Stern and Townsend (2006) who looked at USF in early adopting countries in Latin America that projects can both be identified and proposed by policymakers or by operators and local communities. While the policymakers led initiative is termed a 'top-down' approach, the community and operator-led initiative are called a 'bottom-up' approach since such projects originate from the affected communities and operators who usually have better market information than policymakers. While countries like Colombia, Bolivia and Peru have adopted the top-down approach, Brazil and Chile have used the bottom-up approach to identify USF projects (Stern & Townsend, 2006). Stern and Townsend found that, although projects executed with the bottom-up approach appear more successful, some top-down projects originated by policymakers in Colombia and Peru were also successful. They concluded that while the top-down approach is more suitable for the execution of large-scale projects, a key success factor of the bottom-up approach is the active involvement of stakeholders at the local level right through the planning and execution stages.

Having said that, regardless of the approach a country adopts, USF money is generally disbursed through a competitive bidding process called the 'least subsidy auction' – where the operator with the least subsidy request wins the tender to execute UAS projects (Alleman, Rappoport, & Banerjee, 2010; ICTA, 2004). The winner of

[51] The Universal Telecommunications Services Management Committee (CGSUT)

the bid is also expected to comply with conditions such as rollout dates and specific QoS upon which the regulator sets out to monitor the project for accountability and compliance (Hudson, 2010).

Countries across Africa generally follow the top-down approach where USF administrators are largely responsible for identifying the locations where funds are to be deployed. For example, the USF advisory group, overseen by the USF administrator, is responsible for originating UAS projects in Mauritius, following which a bidding process is conducted with the award to provide UAS given to the MNO with the least subsidy request (ICTA, 2004). The winner of the bid is also expected to comply with seven criteria including costs plan, QoS, quantity of service and implementation plan (ICTA, 2004). Although countries like Nigeria have adopted both the bottom-up and top-down approaches, a lack of interest from and engagement with affected communities mean that policymakers are largely responsible for initiating USF projects (Abdullahi, 2012; Connect Africa, 2010).

Certain countries such as, for example, Ghana and Rwanda also execute UAS projects by outsourcing them to niche providers called 'specialised access providers' (Balancing Act, 2014). The EU contracted one of such providers, Africa Mobile Networks, to provide rural connectivity for about 4 million people who have never had access to telecommunications in parts of Cameroon and DRC for a contract sum of about $26.7 million (Telecompaper, 2017a). The reason for using such niche providers appears to be borne out of their ability to deploy low-cost innovative solutions for mobile telecommunications. For example, constructing solar-enabled towers to address the prevalent electricity problem and using multiple technologies such as satellite, VoIP and Wi-Fi (Balancing Act, 2014).

3.4.5 Summary of USF performance in Africa

From its inception in South Africa in 1998 until recently in 2015 and 2017 when USF began to take shape in Kenya and Gabon respectively, only a handful of studies (for example, Dorward, 2013; GSMA, 2013b; ITU, 2013b; Sepulveda, 2010) have investigated into how these funds are performing across Africa. The central argument that echoed from these studies is that the implementation of USF across Africa is fraught with difficulties and, as such, the performance of various funds has been grossly inadequate - in terms of the failure of USF to close the digital divide in Africa.

For example, after surveying 22 funds in Africa, Dorward (2013) highlighted how poorly conceived underlying legal and policy framework impinges on the ability of USF to be transformative in terms of widening its scope to reflect technological and service changes. Dorward argued that the review process of changing the focus of USF is either too slow or not happening at all, hence, idle funds cannot be disbursed for emerging technology like broadband as this was not their original mandate.

With regards to idle funds, GSMA (2013b) and ITU (2013b) voiced their disquiet on the growing levels of unspent USF across Africa[52]. Although there is a general lack of public disclosure and financial probity when it comes to accounting for money collected and disbursed in Africa, it is estimated that from $575 million collected at the end of 2011, only $175 million was disbursed across Africa (ITU, 2013b). Consequently, over 12 funds in Africa, including Burkina Faso and Mali, are non-operational with money lying idle while policymakers continue to collect levies (GSMA, 2013b; ITU, 2013b). A recent estimation shows that there is about $408 million unspent money across 37 countries, including $10 million in South Africa (iAfrikan, 2018; Thakur & Potter, 2018). It is argued that these unspent USF could be used to narrow the digital divide in Africa through, for example, bringing *"…approximately 6 million women online, or… provide digital skills training to nearly 16 million women and girls…"* (Thakur & Potter, 2018, p. 3).

The lack of public disclose on the financial affairs and overall operation of USF in most countries highlights the issue of a lack of transparency with some exceptions like Uganda – since its inception in 2001/2002 until the end of 2014/2015, RCDF[53] of Uganda has collected over $38 million and disbursed around $37.8 million (UCC, 2015). A lack of transparency makes USF susceptible to corruption and mismanagement, for example, the case of South Africa where the USF CEO and board members were suspended in 2011 due to allegations of corruption (ITU, 2013b). The wider impact of idle funds and corruption is that, scarce resources that could have been used to close the digital divide are either redundant or diverted for personal use while disadvantaged areas lag behind (Dorward, 2013).

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[52] See Section 5.2.5 for more insight on idle funds in Africa.

[53] Rural Communications Development Fund

Another common finding shared by the aforementioned studies (for example, Dorward, 2013; GSMA, 2013b; ITU, 2013b) is the issue of a lack of regulatory independence stemming from political interference from governments and politicians who tend to subvert the operation of USF for their interests. A case in hand is South Africa where a former executive manager of programmes at USAASA[54] alleged that he was dismissed because he refused to award a USF contract of 500 million ZAR following a directive from the ruling African National Congress (Bailey, 2014; van Zyl, 2014). Such action tends to undermine the authority of the regulator and subject USF to bureaucratic inefficiency as relevant staff within the regulator are hindered from implementing USF objectively (Hudson, 2010).

Overall, the implementation of USF in Africa has produced mixed results with a recent study (Arakpogun, Wanjiru, & Whalley, 2017) indicating that more than 20 USF across Africa have largely failed to meet the objective of closing the digital divide in respective countries. The study carried out an assessment of 34 USF using a framework derived from Jain and Raghuram (2009) and ITI (2013), and found that issues like poor policy formulation, lack of accountability and political interference all interact to impinge on the implementation of USF and the effort of various countries to close their digital divides. See Appendix A for a summary of the performance of various USF in Africa. While the result of the analysis indicates that majority of USF across Africa are inactive, some active and better performing funds are highlighted in Appendix B with Uganda being the most exemplary. For example, following the establishment of RCDF in 2003 under the Communications Instrument of 2002, around $38 million was collected from 2001 to 2015 while $37.6 million was disbursed for the deployment of over 7000 projects, including 24000 public payphones, over 600 broadband sites and 880 GSM towers (UCC, 2015). Although there is general lack of public financial records on USF in Africa, Uganda also appears to be an exception as there is a great degree of public financial record of RCDF activities right from the inception of the fund in 2001 to 2015 detailing not only the amount collected and disbursed, but also executed and future projects.

[54] The Universal Service and Access Agency of South Africa

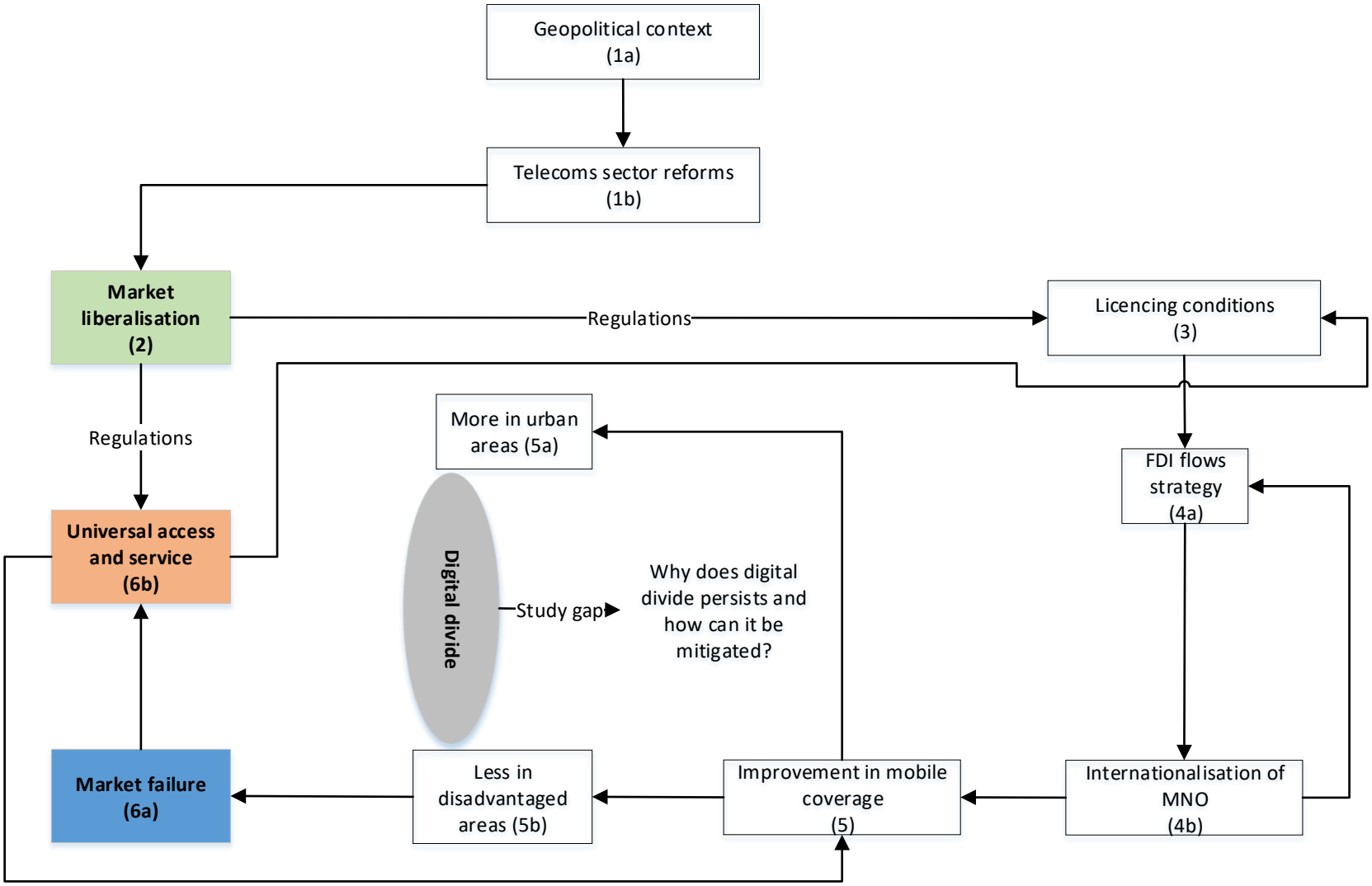
3.5 Conceptual framework

As stated in Chapter 1, the conceptual framework for this study is predicated upon the interaction of market liberalisation, market failure and UAS policy. The investigation of market liberalisation in Chapter 2 shows that competition, driven by the spread of FDI, has transformed the telecommunications sector in Africa and, increased mobile penetration and adoption from 4% in 1999 to around 50% in 2016 (ITU, 1999; GSMA, 2017b). While such evidence highlights the unprecedented impact of liberalisation and competition on the development of the sector, it also indicates that the market has failed to address the digital divide in Africa as over half of the one billion odd people in the continent lack access to mobile telecommunications (Collins, 2015; GSMA, 2016b; Manson, 2013). This shifted the discussion to market failure where Chapter 3 began by exploring the theory of market failure with the aim of explaining why markets fail and the various regulatory instruments that governments can deploy to mitigate its impact. It is within this context that UAS policy has emerged as a policy tool which governments across the world deploy (using various strategies) to address the market failure of uneven access to telecommunications. Figure 6 outlines a summary of the interaction between these three aspects with the numbers in brackets signposting the flow of the process.

As with any given industry, sector reforms and policy formulation are somewhat aligned with the political perspective of a given country and this may vary depending on the system of government and a given political party (Whitfield et al., 2015). Therefore, the geopolitical situation of a given country tends to have an overarching effect on the state of the economy and its industries. This is why the conceptual framework for this study sets out with geopolitical context as indicated Figure 6. According to White et al. (2014), a volatile geopolitical environment poses a great deal of insecurity and risk to investors. This will arguably have a wider implication on the institutional endowment and political stability, which when lacking can undermine the security of FDI and the country as a whole (Mshelia & Anchor, 2018). Investors are particularly wary of this as some governments may behave opportunistically by altering the rules of the engagement to take advantage of those who have made fixed investments like that of telecommunications (Andonova, 2006; Berg & Hamilton, 2002). Therefore, the perception of political risk associated with a given country can affect the FDI flows, which, in turn, influence the overall business

operation and performance (Dupasquier & Osakwe, 2006; Osabutey & Okoro, 2015; UNCTAD, 2018). Geopolitics is thus instrumental to the liberalisation of the telecommunications sector and spread of FDI across Africa following the decision of various governments to embrace reforms and implement the WTO Basic Telecommunications Agreement (Ojo, 2016; WTO, 1997).

Figure 6: Conceptual framework



The telecommunications sector reforms across Africa coincided with the periods when countries like Nigeria and Kenya began to move towards democracy (Muriu, 2002; Whitfield et al., 2015). For example, after three decades of the military regime, Nigeria became a democracy in 1999 and in 2001, the telecommunications sector was opened up through the introduction of liberalisation that ended the monopoly of the inefficient fixed-incumbent, NITEL (Ndukwe, 2005; Okonjo-Iweala, 2012). Following such political decision, three GSM licences were subsequently issued at a cost of $285 million each with the first two going to MTN and Econet while Globacom, an indigenous MNO, was awarded the third licence (Onyeajuwa, 2017; Osabutey & Okoro, 2015). Although telecommunications markets across Africa are generally perceived to have weak political and institutional reforms compared to advance markets in Europe and North America, politics played a key role in the liberalisation of the market at the turn of the millennium (Baek & Qian, 2011; Onyeajuwa, 2017; van-Huyssteen, 2012).

With market liberalisation came a shift in the role of governments from owning and operating networks to policy formulation and regulation (Ndukwe, 2005; Williams & Kwofie, 2014). Governments now regulate the industry through independent and dependent agencies whose responsibilities include the issuance of licences to MNO (Curwen & Whalley, 2018; Sutherland, 2014). Figure 6 indicates that licences are issued with certain conditions rooted in the regulatory frameworks. From the country analysis conducted for this study, it appears that the regulatory frameworks of early liberalising countries tend to influence that of late adopters. This was highlighted in Muriu (2002) where Kenya seems to have adopted a similar regulation to Ghana and Uganda during its earlier stage of liberalisation. Although recent evidence suggests that this has changed over time following various regulatory reforms carried out by Communications Authority of Kenya (CA, 2015).

Having said that, Figure 6 highlights that the licensing conditions across various countries affect the FDI flows strategy of MNO as they spread their footprint across Africa. This is evident in certain markets where a given stake of ownership is required to be held by local investors. Chapter 2 indicated that such licencing conditions tend to influence the FDI strategy adopted by MNO as they cannot own a network except they enter into some form of collaboration with local partners via JV and M&A. For example, the minimum ownership stake for local investors is set at

20% in Kenya, the indigenisation law in Zimbabwe mandates foreign MNO to provide majority shares to local investors while ownership restrictions do not exist in countries like Nigeria and Rwanda (Baily & Hoskins, 2015). In any case, licensing conditions tend to influence the FDI strategy and internationalisation of MNO as shown in Figure 6 with the implication that countries with ownership restrictions may not be too attractive to big players that desire 100% ownership. Although collaborative FDI strategies like JV and M&A offer MNO with the opportunity to share risk and reduce the transaction costs associated with coverage expansion as well as the liability of foreignness (Johanson & Vahlne, 2009), this also means sharing ROI, which some big MNO may not want to do as indicated in Section 2.3.

Fast forward to the turn of the millennium, competition has transformed African telecommunications market into a vibrant and dynamic sector with over 186 MNO operating across the continent at the end of 2016, improving mobile coverage and subscribers than ever before. Nonetheless, Chapter 2 highlighted that mobile coverage varies between countries and regions as the market has failed to provide widespread access to telecommunications in disadvantaged areas compared to urban locations. Although the digital divide of uneven mobile coverage can be observed across Africa as illustrated in Figure 4 in Section 2.2, Eastern Africa appears to be disproportionate compared to other regions within Africa.

The effort of governments to mitigate market failure and close the digital divide of uneven mobile coverage led to UAS as shown in Figure 6. Chapter 3 analysed UAS and found that governments across Africa largely favour the use of USF as a regulatory instrument to tackle digital divide. However, since the implementation of USF is fraught with various difficulties, a digital divide persists as an estimated ‘500’ million people still lack access to mobile coverage across Africa (Collins, 2015; Dorward, 2013; GSMA, 2016b; 2017b; ITU, 2013b; Manson, 2013). This led to the two research questions raised in Chapter 1, one that this study is poised to address and develop a model for closing the digital divide that persists across Africa.

Chapter 4: Methodology

4.1 Introduction

The analysis in Chapter 2 has shown that while market liberalisation and competition have transformed the telecommunications sector in Africa providing access to mobile telephony than ever before, pockets of digital divide persist between countries and regions as evident in the mobile penetration rates. Chapter 3 then investigated further and highlighted that governments across Africa have attempted to close the digital divide by deploying USF as their preferred UAS strategy. However, evidence from the handful of studies (for example, Dorward, 2013; Gillwald, 2005b; GSMA, 2013b; ITU, 2013b; Sepulveda, 2010) that have explored the performance of USF in Africa highlight mixed but largely poor results, with less than ten countries including Ghana, Nigeria and Uganda having active and operating funds. In contrast, over 20 USF in Africa are underperforming due to a plethora of difficulties arising from the implementation of USF. As such, the performance of USF across Africa in terms of narrowing the digital divide is largely disappointing following the estimation that nearly half of the 1.2 billion odd people in the continent still lack a mobile subscription (Collins, 2015; GSMA, 2016b; Manson, 2013). This point to a research gap that both the market and UAS policy have failed to closed the digital divide in Africa, prompting two critical questions:

RQ1 - *with the introduction of market liberalisation and the establishment of UAS strategy like USF, why does the digital divide of uneven mobile coverage persists areas across Africa?*

RQ2 - *how can the digital divide of uneven mobile coverage be mitigated?*

In answering a research question, a particular methodology is adopted which should 'fit' the field of enquiry – where fit refers to the situation where there is coherence between literature review, research question and research design (Edmondson & McManus, 2007). This thesis adopts a multiple case study approach in answering the research questions by drawing data from multiple sources including primary data via 28 semi-structured interviews with relevant stakeholders with knowledge and experience across Africa, and other parts of the world. This chapter aims to provide insight into this methodological approach, what shaped the choices that were made in the process, and how data was collected and analysed. In the end, this chapter will show the research design for this study and argue that the nature of

the research problem the study is trying to address informed the choice of methodology (Patton, 1990; Creswell, 2009).

4.2 Ontology and Epistemology

The philosophical viewpoint of a researcher stems from two broad perspectives – ontology and epistemology, which, in turn, shapes the overall research design and situate a research within a given paradigm (Bryman & Bell, 2007; Saunders & Townsend, 2016). While ontology and epistemology focus on the nature and development of knowledge, the former borders on **'what'** is the nature of knowledge and if such knowledge is the outcome of an objective construct or the human mind (Holden & Lynch, 2004; Walsham, 1995). This argument underlines the existence of two ontological worldviews – objective in terms of the construct of knowledge being external to social actors and subjective where knowledge is built on the perception and action of social actors (Easterby-Smith, Thorpe, & Jackson, 2012; Holden & Lynch, 2004).

Conversely, epistemology centres on the best ways of enquiring about the nature knowledge (Easterby-Smith, Thorpe, & Jackson, 2012). In simple terms, ontology may ask '**what'** knowledge is while epistemology may ask '**how'** to construct knowledge (Crotty, 1998; Walsham, 1995). There are also two epistemological worldviews – positivism in terms of objectively constructing knowledge without the influence of the researcher and social constructionism where knowledge comes into existence as the research relates and interact with realities (Crotty 1998; Pilot & Beck, 2010; Williamson 2006).

This study adopts a subjective ontological approach and argues that the result of this study draws from the viewpoint of different stakeholders such as policymakers, MNO and civil society. Since their interests are different, their views on the digital divide and the overall telecommunications sector in Africa would also differ. Thus, the outcome of this study is socially constructed through diverse opinions (Crotty, 1998; Guba & Lincoln, 1994; Holden & Lynch, 2004). Furthermore, since this research centres on understanding a social problem associated with fostering an all-inclusive digital society through the expansion of mobile coverage by engaging different stakeholders in the industry, epistemology from the viewpoint of social constructionism fits more with the research as the interaction with relevant

stakeholders will be the best means of answering the research questions. This underlines the fact that the nature of the research problems of this study informed the choice of the research paradigm and approach (Creswell, 2009; Hughes & Sharrock, 1997; Patton, 1990).

4.3 Inductive reasoning and qualitative research

Since the epistemological stance of this study is based on social constructionism, an inductive approach is adopted. Unlike the top-down logic followed in studies related to a deductive approach where applicable theories are tested for acceptance or rejection using quantitative data, this study adopts a bottom-up approach associated with inductive reasoning where insights are developed using qualitative data (Crotty 1998; Hyde 2000; Ritchie et al. 2013). There are various definitions in literature when it comes to the meaning of qualitative research (Miles and Huberman, 1994). However, this study adopts that of Sinkovics and Alfoldi (2012: 188), which states that a qualitative research is *"…a set of interpretive activities that seek to understand the situated meaning behind actions and behaviours, and rely heavily on the researcher as a unique interpreter of the data.*" This definition is adopted as it aligns more with the subjectivism research philosophy guiding this study.

In a qualitative study, the goal of the researcher is to develop and generate insights not to arrive at the frequency with which a phenomenon is most likely to happen in a given situation (Hyde, 2000). This can be achieved by providing the accounts of participants and drawing conclusions (Hyde, 2000; Williamson, 2006). This will allow the research to gain an in-depth knowledge in the field of inquiry, as data collection is not strictly limited to predetermined sets of ideas (Hyde, 2000). Bearing in mind that the data gathered in this case are largely or partly associated with the perspective and experience of participants, this raises the issue of interpretation as the researcher tries to make sense of the data (Williamson, 2006; Stake, 2010). This brings to the fore that the theoretical perspective of interpretivism will be used in analysing and making sense of the data gathered from the participants in this study (Crotty, 1998).

Since participants are largely involved in the research process of an interpretivist research, there is the emergence of the researcher and the participants as co-constructing partners in generating meanings (Crotty, 1998; Williamson, 2006).

This is one of the anticipated outcomes of this study as the researcher seeks to produce co-constructed insights by drawing on the views of various stakeholders with hands-on experience and key roles in the sector to develop a model for closing the digital divide in Africa. One of the weaknesses associated with qualitative research is that it may lead to misunderstanding and bias, as the researcher tries to make meaning of the data gathered (Stake, 2010). A qualitative researcher should thus be aware of such limitation and implement routine triangulations by comparing interpreted data with other sources (Stake, 2010; Hines, 2016). Triangulation was carried out in the current study as the interpretation of primary data (interviews) were constantly checked against other secondary sources such as ITU and GSMA databases, previous studies, country analysis and various online articles.

4.4 Case study methodology

A methodology, also known as a research strategy, is a plan of action that underlines the choice and method taken by a researcher to answer a given research question (Crotty, 1998; Bryman & Bell, 2007). Although various methodologies are discussed in the literature, for example, ethnography, phenomenology and grounded theory, this study adopts a case study (Charmaz, 2001; 2006; Crotty, 1998). This choice stems from the interpretivism paradigm and qualitative research approach adopted in this study (Easterby-Smith, Thorpe, & Jackson, 2002; 2012; Hyde, 2000). Furthermore, case studies are often adopted in studies such as this given its usefulness in addressing wide-ranging developmental issues relating to telecommunications, including policies and refining regulatory interventions (Jagun, Heeks, & Whalley, 2008; Menon, 2016; Sutherland, 2015; 2016; Xia, 2016a; 2016b). A case study research is also suitable for addressing research problems with 'why' and 'how' questions (Yin, 2014) as reflected in RQ1 and RQ2. This further justifies that the nature of the research problem for this study informed the choice of the methodology adopted (Creswell, 2009).

The use of case study as a research methodology has been explored by various scholars (for example, Easterby-Smith, Thorpe, & Jackson, 2012; Eisenhahardt, 1989; Flyvbjerg, 2006; George and Bennet, 2005; Hines, 2016; Johansson, 2003; Siggelkow, 2007; Stake, 1995; 1998; 2006; Yin, 2009; 2014). A case study takes an in-depth look at a given phenomenon over a period (Easterby-Smith, Thorpe, & Jackson, 2012). Johansson (2003:2) synthesised the definition of scholars such as Robert Yin and Robert Stake thus: *"The case study should have a 'case' which is the object of study.*

The 'case' should be a complex functioning unit, investigated in its natural context with a multitude of methods, and be contemporary". These definitions (by Easterby-Smith, Thorpe, & Jackson, 2012 and Johansson, 2003) are reflective of this study – the country analysis and examples have enabled the researcher to gain an in-depth knowledge of the state of the wider telecommunications sector in Eastern Africa and more broadly on other parts of the continent. Additionally, UAS became a strategy for addressing digital divide *(phenomena*) in Africa *(context)* post-liberalisation in 1999/2000 *(time),* and data has been gathered from various sources *(multitude of methods)* in this study.

4.4.1 Strengths and weaknesses of case study

Although this study adopts a multiple case study that draws on examples from across Africa, case studies (single or multiple) in general have their strengths and weakness. One of such strengths is its conceptual validity – the extent to which the claims of participants are proven within a study (George & Bennett, 2005). Some phenomena are typically difficult to measure. In order to make sense of such issues, researchers may explore contextual comparisons across different or similar context. Consequently, a case study will then help to identify and measure the factors that best explain the theoretical concepts of interest and thus lead to achieving a high level of conceptual refinement and validity. Secondly, since case studies consider evidence from various sources, they help to identify causal mechanisms in individual cases and facilitate further probing. Furthermore, case studies are instrumental in generating new insights revealing gaps in literature and practice as well as helping to fill them, a feat, which this study is poised to achieve (Eisenhardt, 1989; Siggelkow, 2007).

Case studies are also subject to criticisms, prime of which is that the process may lack rigour (Yin, 2009; 2014). A key reason for such criticism is the tendency of a case study to lack a systematic procedure and allowing ambiguous evidence dictate the outcome of findings and conclusions (Yin, 2009; 2014). To address this, a research needs to have a clear design that reflect a clear research question prior to data collection, a unit of analysis, a link between the research question and the data to be collected, and how data would be interpreted (Garvin, 2003; George & Bennett, 2005; Yin, 2009). The current study followed these steps using an iterative approach as the research questions were generated from the literature and country analysis in Chapters 2 and 3 with the aim of producing proof of validity and rigour (George & Bennett,

2005). Therefore, a rigorous process was undertaken in this study to mitigate some of the concerns associated with using a case study as outlined in Section 4.5. Other areas of interest that help to illustrate the rigour of this study include a unit of analysis, sources of information, iteration and triangulation, and case study protocol.

4.4.2 Unit of analysis

According to Yin (2014), deciding on a unit of analysis may be very challenging and crucial to the research design of a case study. Yin then suggested two steps, which may help in tackling this problem – defining the case and bounding the case. While the former has to do with choosing the 'case', that is, the primary unit of analysis, for example, a specific location, the latter has to do with delineating the 'case' by a time period. The essence of this is to avoid the tendency of wanting to cover 'everything', which in reality is not possible as no single study can solve all problems (Trafford & Leshem, 2008). As such, by choosing a specific 'case' and bounding it, precise and relevant information can be collected to make a better argument and answer a specific research question.

Consequently, the primary unit of analysis adopted for this study is 'country', delineated by time – from 1999/2000 (the starting point of liberalisation in the sector) until 2016. The justification for such choice was to further verify the claim in the literature that areas of low mobile penetration remain in disadvantaged areas despite the sector liberalisation and the establishment of UAS across Africa. Although a multiple case study was adopted in this study with examples drawn from across Africa, a more in-depth analysis was conducted for Eastern Africa as countries in this region have the lowest mobile penetration rate, despite having, on the average, more MNO as illustrated in Chapter 2. Chapter 2 also indicated that while Eastern African countries have more disproportionate levels of low mobile coverage, such digital divide is also evident in other regions albeit with varying degrees. Hence, comparisons between countries across different regions in Africa (as well as other parts of the world) was inevitable, especially where there is a lack of example from Eastern Africa to illustrate the comments of interviewees. This further contributed to strengthening the triangulation process (Stake, 1995).

4.4.3 Sources of information

Benbasat, Goldstein, and Mead (1987) asserted that evidence from multiple sources will combine to support research findings. According to Yin (1994), there are six main sources of evidence, which include archival records, documentation, interviews, direct observations, participant observations, and physical artefacts. This list is by no means exhaustive as there may be other sources depending on the kind of research strategy adopted and the data required (Yin, 1994). Regardless of the sources, it is important to note that they have their strengths and weaknesses. Table 6 highlights the data adopted in this research as well as their strengths and weaknesses

Table 6: Data sources including strengths and weaknesses

Data Sources	Strengths	Weaknesses
Archival Records: for example, various telecoms regulatory websites, ITU and GSMA databases, the World Bank database, research diary, etc.	▪ stable and exact ▪ can be used repeatedly ▪ unobtrusive, i.e., attracts no attention or obstruction	▪ may be difficult to access ▪ may be difficult to retrieve ▪ may be biased in selection and report, i.e., reflecting the views of the author
Documentation: for example, relevant literature, other written reports by ITU, GSMA and other independent consultants such as Sepulveda (2010). Online articles from sources such as TeleGeography, ITWeb Africa, Telecompaper, ITNews Africa, Reuters, Financial Times, etc.	▪ same as archival records	▪ same as archival records
Interviews: with stakeholders such as regulators, USF managers, mobile operators, international lending organisations, representative of civil society, industry researchers, experts and consultants, etc.	▪ targeted directly on case studies ▪ insightful as it provides perceived causal relationships ▪ may help to identify other relevant sources ▪ may be used to explore broader issue	▪ may be biased by poorly constructed questions ▪ may be response bias ▪ gaining access to participants may be a challenge ▪ obtaining the trust of participants may also be difficult

Sources: Compiled by the author from Creswell (2014), Easterby-Smith, Thorpe, and Jackson, (2012), Saldana (2016), Stake (1995) and Yin (1994).

No single source should be seen as having a complete advantage over the other as they all combine to complement each other. Hence, a good case study research will benefit from the use of multiple sources of evidence (Easterby-Smith, Thorpe, &, Jackson, 2012; Yin, 2014). This helps to strengthen the validity of data sources and the information provided (Hines, 2016). Similarly, this study combines multiple sources of secondary data, for example, the literature review, country analysis and databases with primary data sourced through interviews. This act of comparing one data source with others (triangulation) helped this research to guard against relying on a single source of evidence, provided better grounds for argument and helped to counter the bias that may be inherent in a single source. For example, when a regulatory website reports that the country has a certain level of mobile coverage, such claim is then verified by checking other sources like GSMA Intelligence, ITU and the World Bank. Furthermore, in cases where information relating to UAS was obscurely placed on the websites of regulators (lacking clarity and depth), previous studies, as well as other documentary and archival sources, were consulted for further information.

4.4.4 Interviews

One of the most important sources of (primary) data for implementing a case study research is an interview (Walsham, 1995; Yin, 2014). This is because the interview helps the researcher to better comprehend the developments within a phenomenon of interest and helps in verifying and extending knowledge as interviewees share their unique experiences of the subject matter (Stake, 1995). This process also helps the researcher to step back and access the interpretations of participants regarding a subject matter and help reveal information which may not be obvious or available in other (secondary) sources (Walsham, 1995). There is, therefore, a linkage between interview and the interpretivism paradigm adopted in this research as the researcher examines and interprets the underlying experiences and subjective meanings shared by participants (King & Horrocks, 2010).

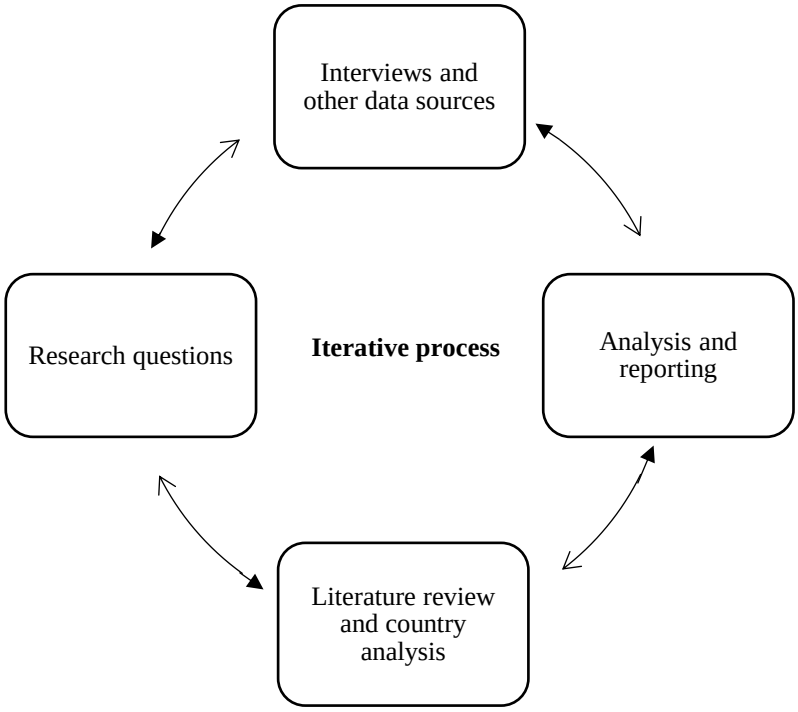
In this study, after the critical analysis of the literature and country analysis was conducted to gain an understanding of the state of the telecommunications market in general and in-depth for Eastern Africa, it became pertinent to conduct interviews. Apart from helping to triangulate with other sources of information, such interviews further contributed to the researcher's understanding of why the liberalisation of the

sector and the establishment of UAS mechanisms have failed to fully address the digital divide across Africa. A semi-structured interview approach was adopted mainly for two reasons (Stake, 2010). Firstly, it offers response categories from which participants can opt for the options that are closer to their views and secondly, it addresses the flexibility limitation associated with structure interview as participants can ask the researcher for more clarity on questions that may be vague to them (Flick, 2009; Jackson, 2015). Issues surrounding the selection of participants, how they were recruited, and the means by which the interviews were conducted are discussed in Section 4.5.

4.4.5 Iterative process and triangulation

When conducting a case study, a case researcher needs to be cautious of the shortcomings associated with this research strategy and make deliberate efforts to mitigate them. One of such ways is through an iterative process, which involves moving back and forth between different sources of information (Eisenhardt, 1989; Siggelkow, 2007). The iterative process adapted for this study is outlined in Figure 7.

Figure 7: Case study as an iterative process



Data source: Adapted from Stake (2010: 186)

Data is sourced from multiple sources such as literature, country analysis, databases, regulatory websites, online reports and interviews. The process of

combining these sources, that is, aggregating the data collected, to make an informed decision is called triangulation. This is aimed at providing confirmability as the researcher analyse the data and writes the report (Denzin, 1978; Hines, 2016; Stake, 2010). For example, evidence from the literature and regulatory websites indicated that countries in Eastern Africa had the lowest rates of mobile penetration compared to other regions in Africa (see Chapter 2). Eastern Africa was then chosen as a more detailed unit of analysis in order to better understand the phenomenon of the digital divide in Africa. As the 16 countries in the region were analysed, the evidence gathered was further confirmed by combining data from various sources such as GSMA and ITU databases, and online reports. Through repeating this process for each country in the region, the problem of digital divide of uneven mobile coverage emerged. This process sheds detailed light on the fact that though digital divide persists across Africa, Eastern African countries appear to be worse-off (AMTW, 2016; GSMA, 2017a; ITU, 2008). On the back of such analysis, Chapters 2 and 3 concluded by raising RQ1 and RQ2, which prompted the sourcing of more data including interviews with various stakeholders with practical knowledge of the industry. Such data was then analysed and reported in Chapters 5, 6, 7 and 8.

Apart from helping to provide confirmability, this process further addressed the issues around the rigour of a case study through validity and reliability (Hines, 2016; Stake, 2010; Yin, 2009; 2014). Yin (2014) delineated validity and reliability into four tests: -

- Construct validity: setting the correct operational process for measuring the phenomena of interest.
- Internal validity: establishing a causal relationship, i.e., where certain conditions may lead to other conditions, instead of things happening spuriously.
- External validity: setting the domain to which the study findings can be generalised.
- Reliability: showing that the process of the study such as data collection can be repeated with the same outcomes.

These four criteria were implemented in the current study following the tactical application in Baker (2012), as highlighted in Table 7.

Table 7: Framework for implementing the methodological rigour of a case study

Test	Tactic	Research Phase	Application in this Research
Construct validity	-Use multiple sources of evidence -Establish a chain of evidence -Have key informants review draft case study report	Data collection and composition	-Data triangulation via the combination of multiple sources such as archival and current records from ITU and GSMA databases, regulatory websites, other online resources, interviews, etc. -Clear explanation of data collection and analysis -Review of interview transcripts by participants in other to verify the interview data and where the researcher was not clear on certain thoughts of participants, further correspondence was made -An independent review of transcripts and coding by peers from Newcastle Business School (NBS) -After such clarification, data coding and analysis were then carried out
Internal validity	-Do pattern matching -Do explanation building -Address rival explanations use logic models	Data analysis	-The research framework explicitly derived from the literature and country analysis helped in pattern matching and explanation of the state of the telecoms industry in Africa -The process was critically executed and the data gathered was used in addressing issues as they emerged - Theory triangulation was also carried out by considering different bodies of research that have addressed the phenomena of interest
External validity	Use replication logic in multiple-case studies	Research design	-In-depth country-by-country mapping and analysis were carried out, especially for the 16 countries in Eastern Africa in order to ascertain the fact that areas of low mobile penetration exit in rural and remote locations -The rationale for chosen Eastern Africa was also addressed
Reliability	-Use case study protocol -Develop case study database	Data collection	-As data were collected from various sources, a case study database was created for each of the country analysis -A case study protocol was created showing how the current case study was executed

Adapted from Baker (2012: i34) and Yin (2014: 45)

The tactics outlined in Table 7 were executed following the iterative process outlined in Figure 7 in order to satisfy the validity and reliability test because as indicated in Yin (2009; 2014), until a research design is repeated, one cannot know for certain if a methodology is reliable.

4.4.7 Case study protocol

According to Yin (2014: 84), a case study protocol is *a "standardised agenda for the researcher's line of enquiry."* It includes not only the instrument but also the procedures and general rules guiding the conduct of a case study (Yin, 2014). The research instrument adopted can either be qualitative, such as interview, or quantitative, such as questionnaire (Maimbo & Graham, 2005). Since the current study is based on a qualitative enquiry by design, the research instrument applicable here is an interview. The use of case study protocol is extremely important when conducting a multiple case research such as this because it does not only guide in data collection but also helps to increase the reliability of the overall process as previously outlined in Table 6.

Adapting the general principles suggested in Yin (2009; 2014), the structure and outline of the case study protocol for this study can be found in Appendix C. It shows the overarching theoretical framework, research questions, interview questions, etc., associated with this study. Looking at the various sections outlined in Appendix C, a case study protocol is indeed a vital tool in conducting a multiple case research as it reminds the researcher what the research is about, focuses on the target of the study, anticipates possible problems and the overall research completion (Yin, 2014).

4.5 The research process and the role of the researcher

The preceding discussions have centred on the justification of the methodology and method adopted in this study. This section seeks to explain how the research approach was implemented (Saunders & Townsend, 2016). This will further help to address the issue of subjectivity surrounding a qualitative research as the researcher gives an account of his role in the research process (Matthews & Kostelis, 2011).

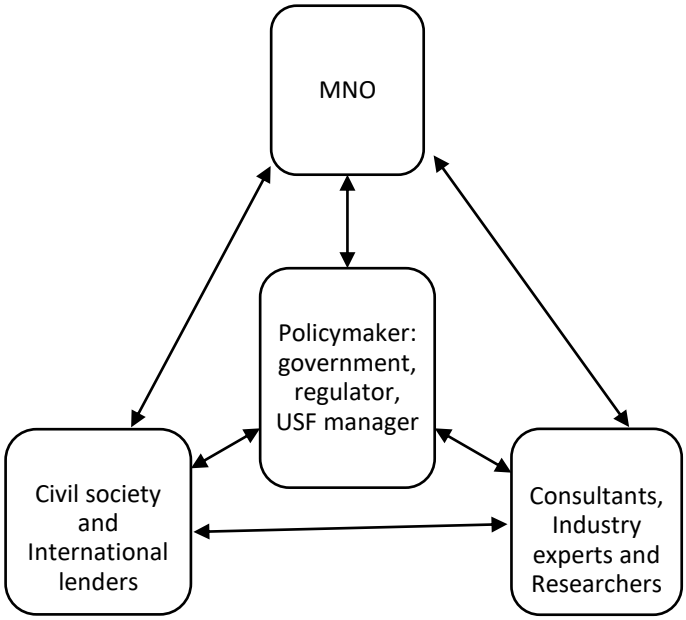
4.5.1 Generating interview questions and identifying research participants

The interview questions emerged in the process of conducting the literature review and country analysis in Chapters 2 and 3. During this process, a topic guide of key issues was constructed upon which semi-structured interview questions were framed according to the category of participants (Easterby-Smith, Thorpe, & Jackson, 2012). The participants for the study were mainly identified and classified using the stakeholder theory as applied in previous studies (for example, Freeman, 2010; Freeman & McVea, 2001; Pouloudi, 1999).

According to Freeman and McVea (2001:4), stakeholder refers to *"…any group or individual who is affected by or can affect the achievement of an organisation's objectives".* Relating this to the current study, these groups of people include those whose decisions can shape telecommunications policy and whose activities can affect the overall development of the sector. Similar ICT studies (for example, Papazafeueioulou and Pouloudi, 2000; Choudrie, Papazafeueioulou, & Lee, 2003; Manh, Falch, and Williams, 2016) have also employed the stakeholder theory in identifying key actors and addressing issues around electronic commerce, broadband adoption and UAS. These studies agreed that identifying and engaging with the relevant stakeholders are crucial to knowing the needs of various groups and designing a more effective and proactive solution in a fast-changing sector like telecommunications.

As such, the identification of the relevant stakeholders is crucial to the success of this study as these people, the researcher believes, hold key information that is partly needed to answer the research questions (Saunders & Townsend, 2016). Since previous studies were conducted in different contexts, it was necessary to tailor the stakeholder theory to fit with the different interest groups within the telecommunications sector in Africa. For example, there was a need to include civil society representative, UAS consultants and OTT players all of whom have hands-on experience and play key roles across Africa. Juxtaposing these groups with those identified in Papazafeueioulou and Pouloudi (2000: 6), the literature and other secondary sources, this study identified and categorised stakeholders using the adapted framework in Figure 8. Policymakers are placed at the centre of the framework as a symbol of the foundation and link that hold other relevant groups together (Manh, Falch, & Williams, 2015). This is because it is the responsibility of national governments to identify relevant groups, engage and coordinate with them in order to ensure successful formulation and implementation of telecommunications policy (Papazafeueioulou & Pouloudi, 2000; Smith, 2003).

Figure 8: Relevant stakeholders



Source: Adapted from Papazafeueioulou and Pouloudi (2000: 6) and other secondary sources.

Furthermore, each group is linked together with arrows indicating the need for some form of cohesion and interactions between and across stakeholders so that the specific needs of different interest groups are reflected in the process (Choudrie, Papazafeueioulou, & Lee, 2003). The categories of participants in Figure 8 were engaged in this study and it was critical that they have relevant knowledge of the subject matter and/or the telecommunications market in Africa, and in other parts of the world (Stake, 1995). In all, four categories of questions were generated according to the interest and the role of each group: (i) policymakers, (ii) civil society and international lenders, (iii) UAS consultants, industry experts and researchers, and (iv) MNO. From over 60 correspondence, 28 interviewees participated in the process with academics, civil society, industry analysts and UAS consultants accounting for more than 50%. Appendix D contains the list of the 28 interviewees by category with the dates and time the interviews were conducted, the reporting of which was anonymised in accordance with the ethical consent form. A sample of the interview questions is attached to the case study protocol in Appendix C.

Given that the interviewees were representatives of a diverse set of stakeholders, it is expected that their comments would include some degree of bias towards their own interests (Bini, D'Ambrosio, & Di Santo, 2017; Boyce, 2006; Kien, 2014; Parent & Deephouse, 2007; Papazefeiropoulou & Pouloudi, 2000; Thai, Falch,

& Williams, 2015). Hence, while the comments of interviewees in this study provide useful insights on how to mitigate the digital divide in Africa, it may also reflect the risk of bias. For example, the issue of taxes and spectrum fees drew more comment from industry groups like GSMA and MNO compared to regulators as evident in Section 5.3.3. Overall, there was a general indication that while stakeholders like regulators commented more on how to promote the public interest element of market failure discussed in Chapter 3, industry representative like GSMA and MNO emphasised more improving economic efficiency. However, the comments from UAS consultants appear to highlight issues from both public interest and economic efficiency perspectives. This is evident in the data presented in Chapter 5.

With this in mind, and following the imbalance in the spread of stakeholder representation in this study as evidence in Appendix D, the researcher is aware that this might lead to some level of bias in the findings. However, it is interesting to note that some stakeholders have worked across different categories. For example, there were instances where a regulator may have worked with an MNO and vice-versa or a consultant who was formerly a regulator. This, to some extent, helped to mitigate bias in some cases as a particular participant, say an MNO, may give an account of the state of a regulator when he/she was a regulator even while speaking as an MNO. For example, Interviewee17 while speaking in the capacity of a consultant in support of tax incentives also highlighted the need to empower regulators with the capacity to enforce compliance in order to ensure that beneficiaries like MNO are held accountable to provide what they ought to for receiving such incentives (see Section 8.3.1.1).

To this end, this study has been conducted with as much impartiality and transparency as possible by, for example, drawing on the diverse knowledge of interviewees through probing questions as illustrated with the case of Interviewee17. Furthermore, triangulation of data with multiple sources from the ITU, TeleGeography, Telecomspaper, ITWeb Africa, Research ICT Africa, A4AI, Balancing Act, etc., was also carried out to mitigate the risk of bias and strengthen the reliability of the outcome of this study. See Section 4.4.5 for details of how data triangulation was implemented in this study.

4.5.2 Accessing and recruiting participants

Since the identification of participants and generating interview questions had contributed to sorting the overall direction of the research, the next phase was to negotiate access to participants and solicit their cooperation in the research process (King, 2004). Gaining access to the identified participants was one of the major challenges of this study (Bryman & Bell, 2007; Easterby-Smith, Thorpe, & Jackson, 2012). This painstaking process needed to be repeated with correspondence back and forth after months of searching for contacts through the internet, reports, publications and attending relevant conferences. When participants were first contacted, some were sceptical and reluctant to participate in the process, but after series of correspondence and a clearer explanation of what the researcher is trying to achieve, they eventually showed positive interest. Furthermore, issues around confidentially and anonymity were dealt with. This initial process contributed to building trust and transparency so much so that after some participants had finished contributing to the research, they willingly recommended and gave contacts to other participants (Saunders & Townsend, 2016).

One of the first means of contact was via email, which was sourced using online resources such as blogs, LinkedIn, organisation and regulatory websites. Some emails were also sourced from written reports and snowballing from other participants. The researcher then followed up these contacts and some of them yielded positive responses while others did not. Other contacts were sourced from academic and industry conferences, for example, Commonwealth WRC Preparatory Meeting, London, 2015 and the 1st African Regional Conference of the ITS, Accra, 2016. The researcher's supervisory team also gave useful recommendations.

4.5.3 The semi-structured interview process

Twenty-five of the 28 interviews for this study were conducted between October 2015 and November 2016, with the last three between March and April 2018[55]. According to Yin (1994), when interviewing participants, researchers must make provision for participants' schedules and availability, not theirs. Therefore, as participants were sourced and consent received, interviews were scheduled based on the time and date

[55] Including two on March 15 2018 at the 2nd Regional Conference of ITS, Lusaka, 2018.

agreed by participants and in some cases, the schedules were changed as participants committed to other activities. The researcher used www.worldtimebuddy.com to convert time zones to GMT. Outlook calendar was also utilised to avoid conflicts with other interviews, research tasks and other engagements. The interviews were conducted through face-to-face and online platforms such as Skype, Google Hangout, telephone, and email. Table 7 highlights the strengths and weaknesses of the various interview methods.

Although piloting is recommended by, for example, Bryman and Bell (2007), there was no 'standard' pilot in this study per se, as access to participants was difficult to get and when some eventually pulled through, the interview was conducted right away. However, interview questions were subsequently amended following reactions and recommendations from participants as the data collection progressed, on whether or not they understood the question(s). This was particularly applicable in the first four interviews. Therefore, in a way, the questions went through some refining process, which is somewhat equivalent to having a 'formal' pilot study. Most participants were only willing to be contacted a second time for the review of their transcripts and that also took a rather long turnaround time.

Most of the interviews were conducted using online platforms such as Skype and telephone due to some constraints. First was the geographical distance between the researcher and the participants, which made it impossible to conduct most of the interviews face-to-face. The second was the constant travelling of some participants as they commute between countries where they had business operations and engagements. Although it was practically impossible to keep following these people around physically, technology made this possible. Three of the interviews took place at the conferences mentioned earlier and participants were willing, in some instances, to do the interview on the spot but this situation was quite limited as they were either presenters or key facilitators at these conferences.

The use of online as a medium of interaction between participants and researchers is not alien to qualitative research as the adoption of the internet expands worldwide and researchers are now adapting face-to-face interaction with the online environment (James & Busher, 2012). Like any other means of data gathering techniques, it has its strengths and limitations (Mann & Stewart, 2000). Table 8 highlights some of those applicable to this study.

Table 8: Strengths and weaknesses of interview mode

Mode	Strengths	Weaknesses
Face-to-face	-relevant additional questions that come to mind can be asked during the interview process -opportunity for both the researcher and the respondent to correct any misunderstandings in terms of the questions or responses	-limited access to wider participants -gaining access and getting the participant to commit to a meeting time
Email	-participants can proffer answers to questions at a convenient time -participants and researcher need not be online at the same time	-may take a longer time to get an in-depth response -the absence of the researcher to ask more probing questions may limit the information provided by respondents -if the participant doesn't have good writing skills in expressing their thoughts, this could negatively impact the quality of response -the response may be less spontaneous due to the time lag between receipt and reply
Skype, Google Hangout, and telephone	-wider reach -helps overcome the geographical limitation -more cost-effective	-network disconnection -loss of coherence and flow of thoughts when contact is restored

Source: Compiled by the Author from Mann and Stewart (2000), Curasi (2001), James and Busher (2012), and personal experience from the interview process.

Nineteen of the 28 interviews were recorded with permission from participants. This was to ensure the accuracy of capture and to avoid the problem of having to recall all the conversations (Carr & Worth, 2001). In order to mitigate some of the limitations outlined above, transcripts were sent back to participants for edit and verification. In some cases, respondents altered or added to what was previously said and some of them were forthcoming in answering further questions for clarity. This further helped to strengthen the trustworthiness of the research (Curasi, 2001). The breakdown of the various methods as well as the quality of interviewees is presented in Appendix D.

4.6 Data preparation and analysis

Apart from the secondary data that were gathered from various sources outlined in Table 5, 28 interviews were conducted. This is consistent with the recommendation of 12-30 participants for a heterogeneous population (Saunders, 2012; Saunders & Townsend, 2016). For the researcher to make sense of these interviews, further preparation was needed beyond the actual conversation with participants (Miles, Huberman, & Saldana, 2014). Firstly, the voice-recorded interviews were transcribed by the researcher to guarantee the confidentiality of participants and to become immersed in the data, and accelerate the coding process (Hahn, 2008). In situations where participants gave further useful comments after the tape recorder was turned-off, such information was then recorded in the research diary. This was later transferred into the transcripts of respective interviewees before sending them back for verification and/or editing. While most interviewees returned their transcripts unchanged, some added to their initial comments. For example, Interviewee10[56] emailed back their transcript with further comments on the activities of OTT players in their country.

Although partial transcription may be suitable to some studies with a focus on the conversation that addresses the research question or theoretical proposition, the audiotapes for this study were transcribed in their entirety (Saldana, 2016; Yin, 2011). This was borne out of the desire to provide a rich description of the thoughts of participants as in-depth as possible (McLellan, MacQueen, & Neidig, 2003). See Appendix E for a sample of transcribed interview. It was after this procedure was concluded that the researcher then moved formally into the data analysis phase, which the approached following an incremental and iterative process by adapting and moving through the five phases suggested by Yin (2011). These include data compilation, data disassembling, data reassembling, data interpretation and conclusion. While the last two phases are covered in the latter part of the study, the first three phases are discussed below.

[56] A USF director

4.6.1 Compiling data

Yin (2011) suggested that an analysis should (formally) begin with orderly compilation and sorting of field data including field notes and other accumulated evidence in order to allow for easy access and reference. In this study, the field data is the interview with participants. After each interview was conducted and transcribed, they were then sent back to participants for verification/edit. It was after this process that the compilation was done immediately. An indication that the organisation of the transcripts was not accumulated and compiled in one lump sum but organised as each interview was completed with necessary feedback from participants.

4.6.2 Disassembling data

Disassembling involves breaking down compiled data into smaller units and (but not necessary) accompanied by new labels or codes assignment (Charmaz, 2006; Saldana, 2016; Yin, 2011). In the current study, the researcher implemented this procedure by going through each interview transcript using each question as a smaller unit. This was particularly useful because participants sometimes switched between issues even though they were answering a non-related question. For example, when some participants were talking about infrastructural sharing, they suddenly switch to issues relating to wider stakeholder engagement and vice-versa. Subsequently, the researcher then sorted various issues into their separate places by disassembling each transcript on a question-by-question basis. This allowed for more robust analysis of individual issues and opportunity for clear patterns and relationships to emerge.

4.6.3 Reassembling data

This involves the rearrangement and recombination of disassembled data in order to reveal plausible relationships and patterns among codes (Charmaz, 2006; Attride-Stirling, 2001). One of the ways this has helped in the current study is that as individual issues were grouped and compared, common relationships emerged. For example, by combining issues relating to infrastructure sharing and stakeholder engagement, a relationship emerged - as MNO combine resources to deploy infrastructure in order to, for example, lower transaction costs, engaging with the local communities has the tendency to further reduce costs. For example, a community may be willing to provide free or ‘cheap’ land for building tower sites for a price below what MNO would have paid without such an engagement. The local communities may also be engaged to

provide security for the tower sites instead of hiring a formal security outfit, which may cost more for MNO and they may lack local knowledge of the area. This relationship only became apparent as the data was reassembled to see the bigger picture (Yin, 2011).

The implementation of these phases was executed following a non-linear process as the researcher moved back and forth between phases, allowing room for flexibility and issues to emerge, making the whole process a recursive and iterative relationship (Yin, 2011). Apart from the data preparation process, another important task in the data analysis process has to do with the identification of codes and themes (Attride-Stirling, 2001).

4.6.4 Codes and themes

Informed by the analysis in Chapters 2 and 3, the codes and themes in this study were a judgment decision on the part of the researcher, which is in line with the interpretivist paradigm of this study (MacQueen, et al., 1998; Ryan & Bernard, 2003; Saldana, 2016). While coding involves the labelling of various parts of data, theme involves the grouping of codes into similar or dissimilar features, moving data analysis from an initial level to a higher conceptual level, which then allows in-depth discussion of events and emergent of more meanings (DeSantis & Ugarriza, 2000; Saldana, 2016). For example, 15 codes may emerge from a chunk of data, and these 15 codes may be grouped into three parts, which may then result in three themes. These themes are subjected to further analysis and discussion, leading to the generation of meaning and insight formulation. Therefore, codes and themes were deployed in this study as a data reduction strategy - to simplify the volume of data accumulated and help to organise and bring meaning to the data (Charmaz, 2001; 2006; Miles, et al., 2014). Both the literature and country analysis in Chapters 2 and 3 extensively (but not exclusively) informed the broad process of code and theme identifications in this study to reflect theoretical and practical perspectives (MacQueen, et al., 1998; Miles, Huberman, & Saldana, 2014). The next section illustrates how codes and themes were generated.

4.6.5 How codes and themes were operationalised

It is important to state in advance that the tool employed for coding was MS Word[57] (La Pelle, 2004; Hahn, 2008). The decision to use MS Word was based on three factors – money, expertise and time (Basit, 2003; Kruckenberg, 2016). The initial plan was to use NVivo[58], but due to the limited training and financial support from Newcastle Business School (NBS), the researcher did not feel comfortable to employ NVivo using a basic knowledge. Since the lack of financial support only became apparent at the later stage of the study, there was insufficient time to improve on the basic knowledge obtained. As such, the researcher was inclined to fully utilise MS Word, which was the tool that was used to execute the initial coding of the transcripts.

Moreover, whether a CAQDAS like Nvivo is used or not, we should not expect any qualitative data analysis tool to unravel 'hidden' codes and themes (Rademaker et al., 2012: 2). All the analytical decision is incumbent on the researcher (Plakoyiannaki, 2016; Yin, 2011). For example, in this study, the researcher decided on the codes assigned to a given chunk of data guided by the research questions, issues raised in the literature and the overall topic of the thesis. The researcher thus created the codes, not the tool employed. Like Nvivo, MS Word also has its limitation (Alfoldi, 2016). For example, the use of MS Word for coding in this study turned out to be tedious and time-consuming (Basit, 2003). Nonetheless, it was a useful tool in the data analysis process. More specifically, it assisted in better planning and management of data in terms of coding and retrieval, discovering and marking interesting aspects of the data using different colours (Lewins & Silver, 2007).

Having said that, the coding process began with a line-by-line reading of each transcript. Since the researcher conducted and transcribed the interviews personally, open coding[59] began upon a second reading, as the researcher had become immersed and familiar with the data (Ryan & Bernard, 2003). In the open coding process, the researcher went through the transcripts and then began to generate tentative codes for

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[57] Microsoft Word

[58] A Computer Assisted Qualitative Data Analysis Software (CAQDAS) (Lewis & Silver, 2007; Weitzman, 1999).

[59] Open codes involve the initial identification and labelling of relevant information emanating from the data while axial codes goes further to assist in organising codes into themes for better examination and discussion (Hahn, 2008; Saldana, 2016).

chunks of data drawing on the knowledge gained from Chapters 2 and 3. The researcher also documented examples of participants' direct words for each code in order to preserve the embedded meaning as intended by participants (Charmaz, 2006; Gallicano, 2013a; Ryan & Bernard, 2000). For example, see the screenshot in Figure 9.

Figure 9: A screenshot of MS Word exemplifying the code and theme processes

As far as I am concerned, it (USF in South Africa) is still extremely poorly managed - I don't believe that they really apply the funds for what it was targeted for. Also, it is either a huge pot of money sitting there or it is unappropriated by the government and this has been the case to a larger extent since, I think 1995, when the fund was established. So in my view, government has done an exceptionally poor job with regard to that. One of the reasons responsible for this is that the entity responsible for managing the fund and allocating it for the purpose of providing connectivity in the underserved areas is run by government bureaucracies. I know of several instances where there have been request for services in some underserved areas but operators do not get the needed response from the entity. In my view, the whole management and operational side of it need to change.

Interviewee15: a key MNO figure

emmanuel.arakpogun

Answer to research question 1: Poor USF implementation: due to Funds diversion

Response to **RQ1**

Theme

Code

Interviewee24: an academic and UAS consultant

Another important thing is to try and consider different technologies, you know, because very often when people talk about mobile, they seem to talk about circular technology, but if we speak of mobile in a broad sense, we can see that, for example, satellite is mobile a way mobile, or Wi-Fi, or WiMAX, or other technologies. One should think about this mix of technologies in order to bring mobile connection or internet to everybody as this will bring true connectivity to countries with not just one specific technology but a mix of them. I also think this is important for policy makers so they will not just focus on one, but also try to think as technology is always developing. For example, maybe you've heard about this project by google - project Loon? This could also bring connectivity if they go through with it and it is not cellular technology, it looks completely different. So this will be my first remarks about your question.

emmanuel.arakpogun

Answer to research question 2: **Encourage innovation** through the deployment of Inexpensive and heterogeneous technologies

Response to **RQ2**

Theme

Code

Following the coding process, themes were then abstracted from the codes generated. For instance, responses to RQ1 generated codes such as inadequate regulatory capacity, fund diversion and corruption. These codes were then combined and discussed under a single theme called 'Lack of strong ICT leadership and commitment' (Section 5.2). Furthermore, in order to represent the data succinctly, themes were further refined not only to make them more specific and discrete, but broad (constructs that link different kinds of expressions), embodying the ideas contained in the data (Ryan & Bernard, 2000; 2003). As the researcher went through the transcripts, a number of codes were accumulated and recorded (Ryan & Bernard, 2000). Such recording was particularly useful for keeping track of codes, organising and reorganising the codes as they emerged through the data analysis process (Saldana, 2016). After open coding was done for each transcript, axial coding was then carried out as categories of codes were grouped in order to identify underlying relationships and from this emerged the themes (Gallicano, 2013a; 2013b).

Considering the high level of subjectivity associated with coding and the fact that different researchers may assign different codes to the same chunk of data (Miles, et al., 2014; Saldana, 2016), the researcher solicited the services of other people to validate the process. One of such measure was constant 'shop talking' with peers, friends, and supervisors about the research and data analysis, knowing that this could lead to provocative questions that the researcher may not have considered (Saldana, 2016). Secondly, peers from NBS were engaged to independently review five transcripts and carry out their own coding for comparison with that of the researcher. While the results from peers were exact in most places, there were instances where they used different words, which more or less had the same meaning as that of the researcher. For example, there was a chunk of text that the researcher coded as 'stakeholder engagement' (Sections 5.3.5.4 and 6.2.3), which a colleague codded as 'multi-stakeholder consultation/engagement'. This process did not only offer more validity to the research, it also proved useful in articulating the researcher's thinking, clarified emerging issues, developed new insights and revealed better connections between codes and themes (Saldana, 2016).

In conclusion, the whole process of codes and themes followed an iterative pattern as the researcher moved back and forth within data, codes, and themes, guided

by the overall research questions that emanated from the literature and country analysis (Sinkovics & Alfoldi, 2012). Figure 10 outlines this process.

Figure 10: Framework for coding and thematic analyses

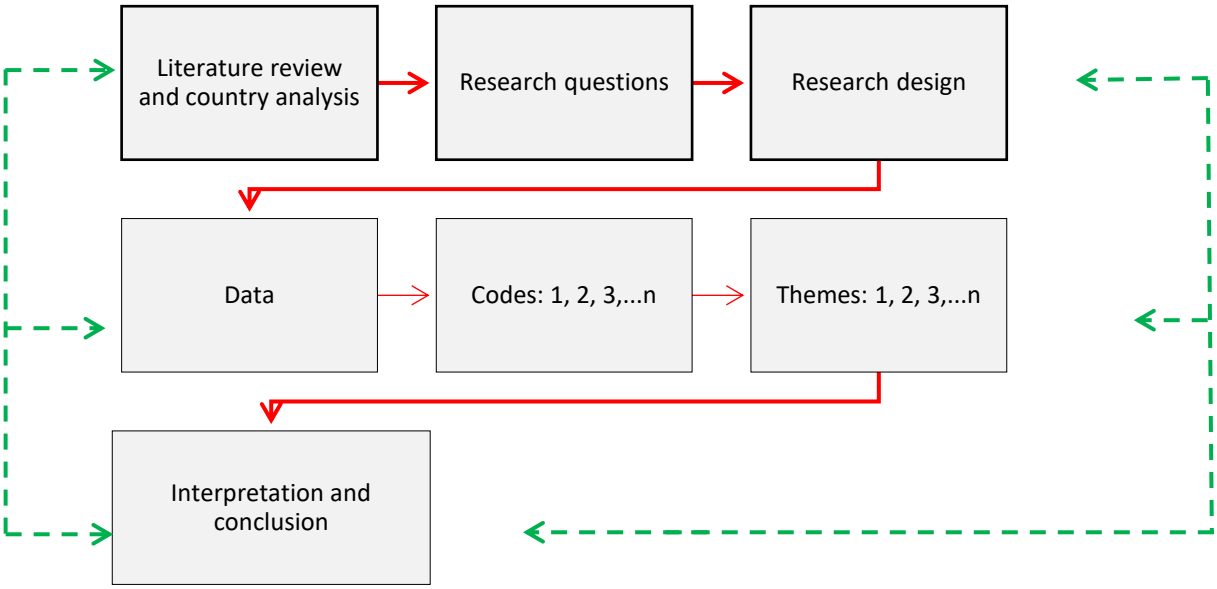


Figure 10 outlines the process used in the data analysis process. The thick red lines show the interaction between different phases while the dotted green lines show the repetitive and non-linear interaction between phases. It can be observed that as codes were assigned and reassigned, the researcher kept following an iterative process on an incremental basis, moving into higher conceptual level (themes) until the main researcher questions were addressed (DeSantis & Ugarriza, 2000; Yin, 2011; 2014). Since these research questions emerged from the literature and country analysis (conceptual framework), it was also necessary to closely intertwine the whole process by moving back and forth between various elements – conceptual framework, research questions, and data analysis (Sinkovics & Alfoldi, 2012). In other words, theory was compared to data, data to theory, data to data, data to code, code to code, code to themes, themes to themes, and themes back to data (Saldana, 2016; Sinkovics & Alfoldi, 2012). Figure 10 also provided a flexible model to follow as data was coded and recorded giving room for adjustments where necessary, after all, *"...no one gets it right the first time"* (Saldana, 2016: 38) even though he or she may think otherwise (Miles, Huberman, & Saldana, 2014).

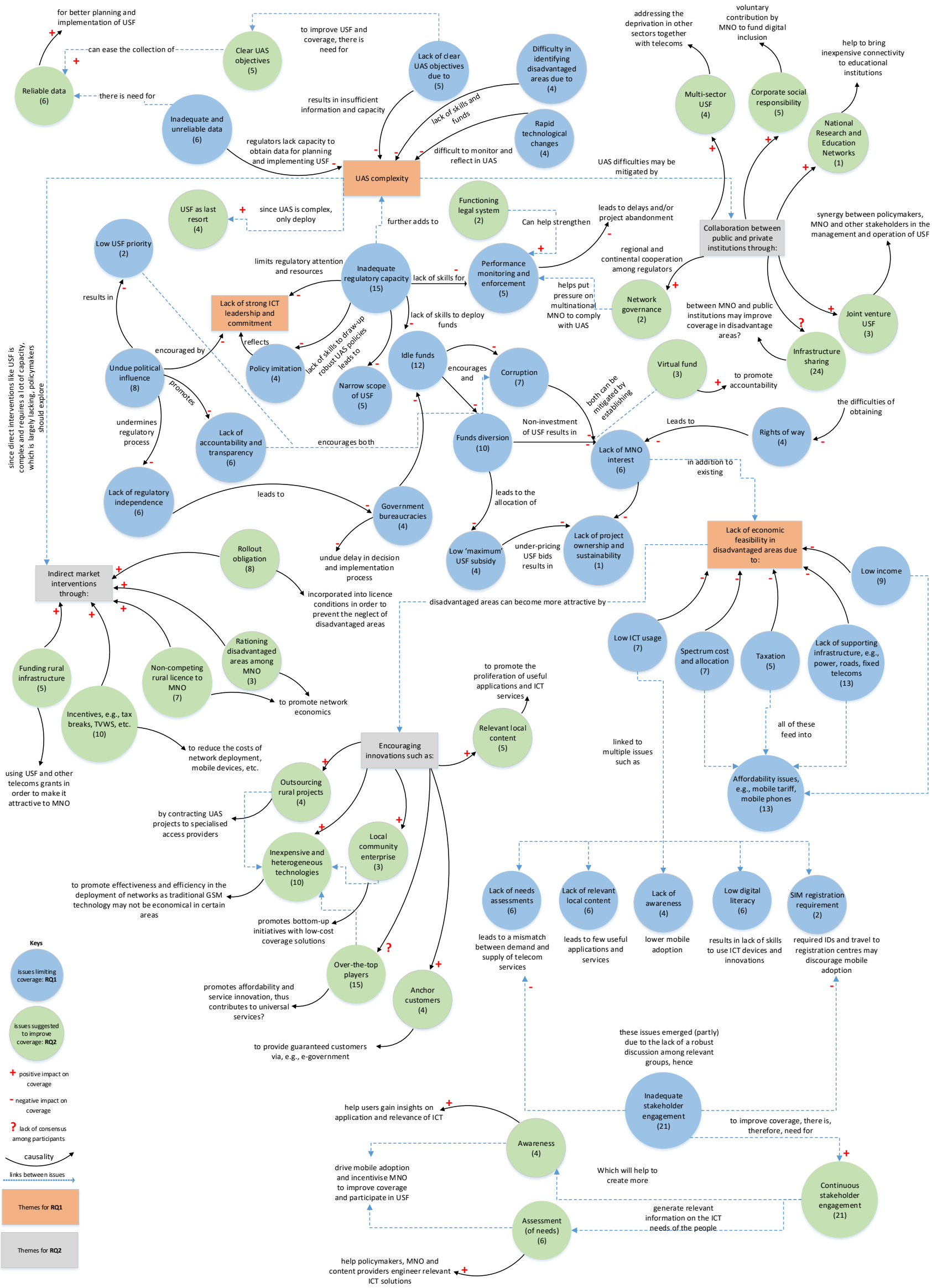
Since the primary data in this study was sourced from people, it then informed the need to address ethics - issues around the safety and protection of participants as well as the information they have shared (Yin, 2014). The researcher anonymised

responses by using Interviewee1, Interviewee2, etc., and kept data in accordance with university guidelines. A sample of the approved informed consent form is contained in Appendix F.

4.7 Data mapping description

The data map in Figure 11 illustrates the outcome of the data analysis process discussed above with a synthesis of the overall issues that emerged from the data as various interviewees recounted their experience and knowledge of the digital divide across Africa and other parts of the world. Figure 11 indicates that UAS policy is a complex and dynamic process with a series of interrelated issues. While the data presented highlights some of the reasons why the digital divide in Africa persists, it also offers some insights on how to mitigate the problems identified. The various issues raised in Figure 11 are differentiated using various shapes and symbols. This was necessitated by the desire to make sense of the messiness of the data as the analysis of the 28 interviews generated a raft of issues, which increasingly became confusing just by going through the transcripts and documenting the evidence.

Figure 11: Overall emerging issues from the data: the big picture



Thus, the use of Visio was borne out of the desire to address this confusion and help the researcher to better understand and present the myriad of issues emerging from the data. The blue circles represent issues behind the persistent low levels of mobile coverage in Africa as recounted by the interviewees while the green circles indicate the recommendations given on how to mitigate the problems that were identified. These were subsequently delineated into issues related to RQ1 – the blue circles – and RQ2 – the green circles. A higher-level categorisation was then carried out to generate the various themes under each research question. All issues relating to RQ1were themed using the orange rectangles and RQ2 using the grey rectangles.

Figure 11 shows that UAS is complex and dynamic with a series of interrelated issues signposted by the dotted blue lines. If one were to pick on the theme: 'Lack of strong leadership and commitment', for example, Figure 11 indicates that a series of issues feed into this theme. Note that these issues are connected to the theme using arrows, which indicates causality, that is, a lack of strong leadership and commitment, according to the interviewees, is because of inadequate regulatory capacity, undue political influence, etc. Since these issues reflect on each other, the blue dotted lines depict the linkages and dynamism in the data. The various issues that were raised by interviewees tend to have either a positive or a negative impact on mobile coverage. Some of these issues were highlighted in Section 2.4 using the pull (negative) and push (positive) factors. This is signposted by the positive and negative signs at the tip of the arrows. The issues that lacked consensus among interviewees are highlighted by question marks, for example, the impact of OTT players and infrastructure sharing on UAS in disadvantaged areas proved divisive. The numbers in bracket indicate aggregate interviewees' responses.

Although Figure 11 highlights a series of complex relationships, seven themes stand out in relation to the two research questions. RQ1 covers three themes, namely, lack of leadership and commitment, economic feasibility and UAS complexity, while RQ2 covers four themes, improving the current form of USF, indirect market interventions, collaboration and innovative solutions for UAS. The presentation of these seven themes will be split and discussed in Chapters 5, 6 and 7. In these chapters, the data map will be fragmented along the lines of respective themes to further simplify the message relayed by the interviewees.

4.9 Conclusion

This chapter has discussed the research philosophy, methodology and method for this study. The purpose of this is to provide justification for the research strategy adopted for this study and to document the process of how the research design was implemented. It was argued that the nature of the research problem informed the choice of the research approach. Using a multiple case study strategy, the research adopted a qualitative approach to data collection and analysis. Multiple sources of data were sourced including primary data via semi-structured interviews with relevant stakeholders with knowledge and experience across Africa, and other parts of the world. This further supported the iterative process as data from various sources were triangulated to gain an in-depth understanding of the mobile telecommunications industry in Africa and to address the issues surrounding the rigour of the study.

Chapter 5: Findings – Limited coverage

5.1 Introduction

This chapter will present the findings from the data with respect to ***RQ1*** - *with the introduction of market liberalisation and the establishment of UAS strategy like USF, why does the digital divide of uneven mobile coverage persists areas across Africa?* Applying the iterative framework outlined in Section 4.6.5 to the 28 interviews, three themes emerged: lack of strong ICT leadership and commitment, lack of economic feasibility and universal access and service complexity.

These themes will be presented and illustrated in detail with interviews excerpts in italics highlighting the voices of interviewees. This process will also articulate emerging relationships between issues and triangulate it with evidence from relevant literature, country examples, databases of GSMA and ITU, online articles, etc. in order to ascertain the veracity of what is being said and add to the validity of this study. The chapter then concludes with a summary and suggest issues for further examination in the discussion chapter drawing on the analysis from Chapters 2 and 3, the level of interconnectedness of issues from the data and aggregate interviewees' responses.

5.2 Lack of strong ICT leadership and commitment

The lack of strong leadership and commitment to ICT related issues was highlighted by six interviewees as one of the main hindrances to the expansion of mobile coverage in disadvantaged areas and further development in the sector. Drawing on a synthesis of the comments from interviewees, ICT leadership and commitment refers to the resolve of various national governments to put ICT related issues at the heart of their economic and political agenda and debates. A position that this group of participants said is lacking in certain parts of Africa. For example, Interviewee23[60] noted that:

> *In the developed countries, you see high political office holders like the Prime Minister talking about the ecosystem of telecom services but in developing countries like Nigeria, Ghana, etc., the leaders are not so much into this. They are more concerned with visible projects like bridges, roads… I am not saying these are not important, but the leaders are not talking about telecom services as it should be and I think they are missing out on something by not giving this sector top priority.*

[60] One former USF CEO, who consults for the ITU and some countries in Africa

Interviewee6[61] added that governments should not only be willing but also able to support such discussions with the needed attention and resources. Although this ought to be reflected in the vision of national government and political leaders in terms of expressing long-term genuine interest in transforming and integrating a country into the global information economy (Cross & Adam, 2007; O'Donovan & Johnson, 2016), Interviewee13[62] disagreed. Interviewee13 noted that from their interactions with governments across the continent, it appears that most governments are more focused on *"short-term vision"*, that is, a political situation where people think only in terms of their tenure in office when it comes to ICT instead of looking at the wider impact of their actions. Although it was generally agreed by this group of interviewees that certain countries in Africa seem not to be doing enough to reflect the importance of leadership in ICT, one civil society and access specialist drew attention to two exceptions: Kenya and Rwanda. Recounting their experience from the region, this interviewee argued that both countries have benefited from very strong leadership within government:

> *So, in Rwanda, obviously Paul Kagame as the President has set an ICT agenda for the country but equally, in Kenya, Bitange Ndemo played a catalytic role in setting an ICT agenda for Kenya…There is such a strong sense of pride in Kenya's leadership in ICT that it often trumps the issue of mistrust...such strong government leadership can actually be transformative.* Interviewee1[63]

Section 2.5 appears to support the experience related by this interviewee that the drive from these top political leaders has contributed to the level of success achieved in their telecommunications sectors. This is evident by the relatively better mobile penetration rates in Rwanda and Kenya - 70% and 78% respectively, for year-end 2016 compared to the other 16 countries in Eastern Africa, excluding the small-island nations of Mauritius and Seychelles with over 100% (see Figure 4, Section 2.2). Furthermore, Dr. Vanu Bose, the CEO of Vanu – an access specialist provider – stated that they are currently building local mobile network to connect over one million unconnected people across Rwanda and that part of the reasons for accepting the project was because of the 'very pro-ICT' attitude of President Paul Kagame (Gilbert, 2016b). He

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[61] An independent telecommunications policy analyst with expertise in Africa and other parts of the world

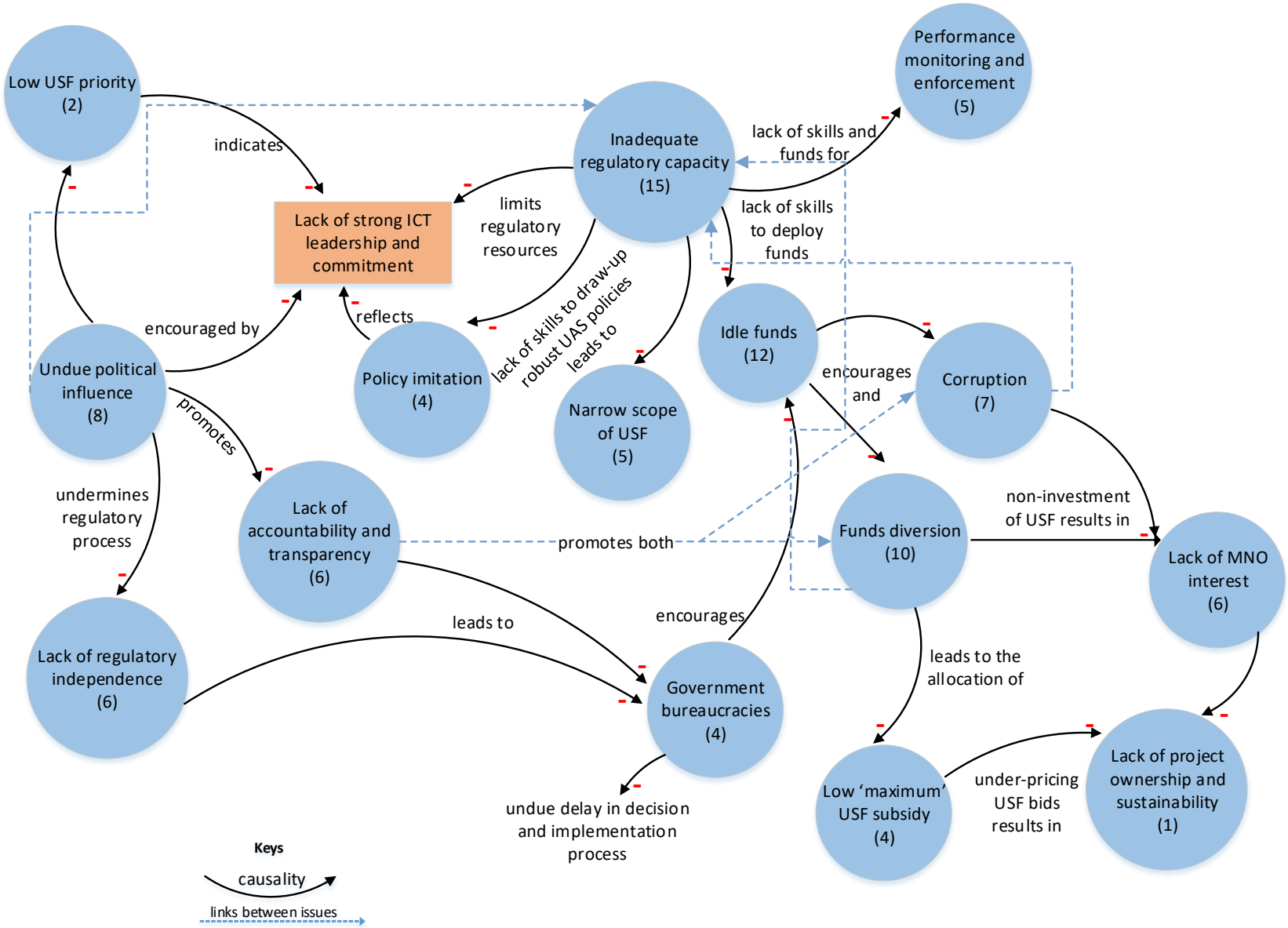
[62] One key multinational MNO employee in charge of regulatory policy across Africa

[63] A civil society representative and access specialist promoting the proliferation of low-cost infrastructure in disadvantaged areas in emerging markets including Africa

concluded that other countries in Africa could draw parallels from the strong ICT leadership in Rwanda.

Having said that, the interaction with various interviewees revealed that the impact of a lack of strong ICT leadership and commitment on the implementation of USF and the expansion of mobile coverage to disadvantaged areas is reflected in a host of interconnected issues. In contrast to the complex data map presented in Chapter 4 (Figure 11), Figure 12 portrays a more focused version to clearly highlight the dynamics as discussed below.

Figure 12: Lack of strong ICT leadership and commitment



5.2.1 Inadequate regulatory capacity

At the heart of the issues presented in Figure 12 is regulatory capacity - the level of relevant skills and funds available to enable regulators to discharge their duties. Fifteen interviewees, including Interviewee5[64], argued that although regulatory capacity is critical to the success of USF in advancing mobile coverage, regulatory bodies across Africa are generally faced with shortages in skills and funds. For example, one regional head for access policy in Africa stated that:

> *Once these monies have been collected, how do you now make sure it is channelled to the right place? This leads to the second problem, which is the lack of expertise on the part of the regulator in the deployment of the funds collected in terms of maybe determining the areas that need the funds… The cost of the contract also needs to be worked out…* Inerviewee4

Interviewee1 added that from their experience, people with the right technical and business expertise needed to quickly design coverage solutions do not run USF in Africa. Although certain countries try to overcome this difficulty by enlisting the services of consultants, this strategy seems not to have fully addressed the problem in the long run. Interviewee11[65] underlined this by noting that although it is part of their reference point to transfer skills to regulatory personnel to continue when they leave, the skills are so specialised and difficult to transfer within a short period. The consultant further added that this leaves a regulator lacking critical skills such as technical, economic and legal to deploy, manage and sustain UAS projects.

Interviewee5 further asserted that:

> *This* [shortage of regulatory capacity] *is true particularly in the countries where these funds are most needed in the sense that the more you need the fund the less capacity you have to manage it.*

This interviewee articulated that the inability of regulators to compete with larger corporations in offering a competitive salary to attract and retain skilled labour is a contributing factor to the lack of regulatory capacity. Although this is a general reflection of the low salary applicable to the civil service in comparison to the private sector, insufficient regulatory funding is also a determinant. A recent example of this can be found in Zambia where the president issued a directive to reduce funding for

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[64] A well-established UAS consultant and research with over 20 years industry experience

[65] A USF specialist and UAS researcher with over 15 years' experience across 17 countries in Africa and the ITU

the sector regulator (Malakata, 2017b). The president of Zambia argued that this is meant to 'transform' the regulator into a profitable institution that is capable of contributing more to the treasury. However, the civil society is concerned that such action could lead to a lack of funding and limit the ability of ZICTA[66] to formulate and deploy policies aimed at increasing access and ICT adoption.

Apart from the fact that inadequate capacity limits regulatory capability and resources, which then impinges on a regulator's ability to function and attract qualified personnel, it has other far-reaching consequences as shown in Figure 12. The remaining sections under this theme will further examine these issues.

5.2.2 Lack of performance monitoring and enforcement

Since Section 5.2.1 highlighted that regulators are generally faced with inadequate capacity, Figure 12 indicates that the resources (skills and funds) for monitoring and enforcing compliance on issues like UAS are limited. The comments from five interviewees, including Interviewee9[67], help to underline this argument. Interviewee17[68] noted that:

> *…there are often no very good ways of monitoring performance even if they are clear on what they are trying to achieve. So often, there are no very good ways of measuring… whether or not all the people the operator say they have connected to the network, as a result of receiving the subsidy, have actually being connected…* Interviewee17

Interviewee6 and Interviwee21[69] added that to ensure compliance with project specifications such as timely completion, technical and quality agreements, USF needs to be monitored and where failings are observed, regulators need to hold MNO to account in order to prevent a free rider problem. This is a situation where MNO collect USF without constructing the network and providing telecommunication services as hinted earlier in Section 3.2.2. Interviewee23[70] added that in countries where this occurs, USF could do very little in terms of pushing coverage expansion to

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[66] Zambia Information and Communications Technology Authority

[67] A head of spectrum administration

[68] A former multinational MNO executive, now a senior international policy adviser

[69] A former public policy director for a multinational MNO

[70] A former USF CEO who now consult for the ITU and some countries in Africa

disadvantaged places. Interviewee12[71] extended the discussion to the inability of some countries to make big multinational MNO comply with coverage obligations due to their wealth and influence relative to the host country. Interviewee12 made a comparison between Nigeria and Zambia by referring to the $5.2 billion fine on MTN for failing to disconnect unregistered SIM cards (see Section 5.3.5.3). Interviewee12 argued that since Nigeria is the biggest market in Africa in terms of subscribers, the government has some level of leverage, however, a smaller market like Zambia may struggle to contend with the wealth and influence of MTN. Interviewee12 concluded that:

> *Nigeria can pull its weight because it is bigger, South Africa and a few others as well, but a lot of the smaller countries cannot. Yes, it* [compliance] *is probably in the licence terms but the operators don't do it, what can the smaller countries do? I don't know.*

In other words, although some countries may be willing to actually enforce the expansion of mobile coverage to disadvantaged areas, their inability to make large MNO comply could undermine such effort.

The argument above indicates that to successfully implement performance monitoring and enforcement, regulators need capacity in terms of skills and funds to police the process and hold MNO to account. It is more likely that in countries where regulators have fewer resources, the impact of USF would be limited as MNO could take the subsidy and fail to execute projects as specified in their contracts. While this may be linked to the lack of political will of policymakers to support the plan of building an all-inclusive digital society with the required level of capacity, the relative power of big MNE to smaller countries could also be a contributing factor. While a regulator can retract the licence of MNO for failing to meet their licence obligation as illustrated with the case of RwandaTel (Section 2.5), Interviewee12 highlighted that when it comes to MNE, this could lead to the loss of jobs and increase in unemployment, a risk that policymakers would presumably want to avoid. Consequently, the incentive to execute this regulatory task appears rather weak. Figure 12 thus indicates an underlying relationship between regulatory capacity and performance monitoring in the sense that a regulator with less capacity can do little

[71] A key figure of a specialised access provider

when it comes to USF monitoring and enforcement, which is part of the key success factors of deploying such regulatory instrument as indicated in Section 3.2.2.

5.2.3 Policy imitation

Another consequence of inadequate regulatory capacity is the issue of policy imitation – a situation where certain regulatory bodies 'copy and paste' frameworks from other countries and/or international organisations directly with little or no modifications to adapt such laws to the dynamics at play in their respective countries. The comments from four interviewees highlight this argument. For example, Interviewees20[72] and 28[73] noted that:

> *The USF model that is generally deployed in Africa is one that originated in Latin America back in the 1990s… There is always a question about whether it is transferring success out of the original Latin American countries to other places… I would question whether a model that was developed in the 1990s for a very different telecoms industry is likely to be the best model for today.* Interviewee20

> *Some regulators have also adopted a 'copycat' approach to policy formulation – this is evident when you take one country's policy and compare with another, you will find that they all look the same.* Interviewee28

This sentiment was also shared by Interviewee4[74], who asserted that the tenets upon which the so-called Latin America model of USF are based emanated from the World Bank and that governments across Africa have, more or less, *"copied and pasted"* these policies without considering its implications and suitability to their contexts. Interviewee6, who was particularly vocal about South Africa, added that some countries have telecommunication policies that appear satisfactory on paper but fraught with difficulties in its implementation. For example, this interviewee stated that although South Africa came up with the idea of issuing 'unserved and under service area licences', the implementation never materialised due to a flawed policy. See Section 6.3.2 for more insight.

The comments from interviewees thus suggest that although it is critical to examine and reflect local factors in the decision-making process of a regulatory framework as various countries are dynamic and have their fundamental differences,

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[72]A former head of an intergovernmental ICT body, now an independent consultant and researcher

[73] A former regulatory head

[74] A former regulator who is now a regional head of access policy for a multinational OTT

some parts of Africa, significantly late adopters of liberalisation, pay little or no attention to this when drawing from alien policies. This confirms the argument in Section 3.5 that the regulatory frameworks of early liberalising countries tend to influence that of late adopters. As such, the implementation of USF becomes problematic and difficult to execute and manage. This underlines the argument that a 'one size fits all' approach would most likely yield less result in a dynamic sector like telecommunications (ITU, 2013b; O'Donovan & Johnston, 2016). Figure 12 indicates that a possible reason for policy imitation in the region could linked to the lack of regulatory skills needed to draw up country-specific policies for UAS. Therefore, such policies do not account for local factors and this is reflected in the inefficiency of USF to expand mobile coverage in disadvantaged areas across Africa.

5.2.4 Narrow scope of USF

Apart from policy imitation, Figure 12 highlights that another impact of inadequate regulatory capacity, as supported by five interviewees, including one UAS director, is the narrow scope of USF in terms of the variety of telecommunication services covered by UAS. Interviewees articulated that regulators not only lack the skills needed to draft a robust policy framework that can capture the diverse telecommunication needs of the public, they also lack the financial resources to expand the reach of USF in terms of the number of projects it can effectively monitor. This then restricts the ability of USF to push mobile coverage into disadvantaged areas. For example, Interviewee5 stated that:

> *…another difficulty is that… these funds have been around for a while considering when they were originally set up, the purposes for which the funds could be used were defined rather narrowly…but we need to do other things with the money now not the original ones and the simple example of that is that the money could be reserved for fixed development when what we really want is mobile…* Interviewee5

Interviewee19[75] added that many USF frameworks may have been well configured for voice solutions but may not fully account for mobile networks as a means of providing internet usage for people. In other words, policies that are suitable for the provision of voice access may not be the best possible solution for providing data access. This interviewee then asserted that since telecommunications is constantly and rapidly

[75] An independent research with interest in developing digital inclusion in developing economies

changing, the implementation of USF should reflect such changes to avoid undesirable results:

> *…telecoms is a moving target in the sense that if you are administering funds based on old technology, it is not going to fit.* Interviewee19

Interviewee17[76] commented that one of the reasons why narrowly defined scope may undermine the performance of USF is the fact that since mobile telecommunications now include voice and data, targeting USF on voice alone may be counterproductive, as people are now increasingly in need of access to data almost as much as they need voice. Interviewee17 added that, providing one service (voice) and excluding or paying less attention to the other (data) may cause coverage gaps to persist.

With respect to data, although this group of interviewees agreed that USF should be extended to cover emerging services like data, there seems to be a lack of consensus on what form of data should be considered as part of UAS. For example, Interviewee20 was of the opinion that for USF to really address digital gaps, the scope has to be extended to the provision of new technology and services like broadband. In contrast, Interviewee25[77] disagreed arguing that it is a bit too early for African countries to include broadband within UAS, as it may not be economically viable at this stage of their telecommunications development. Such a disagreement is also highlighted in the literature in Section 3.3.4, where various UAS scholar failed to agree on what UAS should cover as technologies and services evolve. Interviewee19 then suggested the need for further research in order to provide more clarity on what should constitute *"minimum"* data.

5.2.5 Idle funds

Figure 12 indicates that a further consequence of inadequate regulatory capacity is reflected in the accumulation of large sums of unspent money lying idle in various USF across Africa. Although an accurate figure for this sum is lacking due to a dearth of public data, Section 3.4.5 projected over $400 million at the end of 2013. Although the regulators and fund managers interviewed for this study were reluctant to comment on this, 12 interviewees, including two established UAS experts who have consulted

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[76] A former multinational MNO executive responsible for public policy, who is now an international policy adviser

[77] One UAS director

and executed projects for various government across Africa, did voice their opinions. Their comments highlighted that idle funds are a chronic problem that hinders the implementation of USF in Africa and that this is partly connected to the lack of skills needed to quickly design projects and deploy funds. For example, Interviewee8[78] disclosed that:

> *There are multiple reasons for that* [idle funds]. *One… is a lack of skills and experience in infrastructure deployment… it is simply wrong to have USF resources sitting idle. If a USF is unsure what to do, they need to take note of some of the latest deployments in the likes of Kenya, Tanzania… and take a lead from there…* Interviewee8

Interviewee23, recounting an experience from the region, asserted that collecting levies for USF seem not to be a problem as the funds keep coming in from MNO but the problem lies in their non-disbursements. Unsurprisingly, Interviewee11[79] asserted that MNO find such practice unpleasant as they complain that USF levies are just another form of taxation since governments collect the money without releasing it to support the expansion of coverage to disadvantaged areas as intended.

Apart from the lack of skills to design projects and deploy funds, interviewees also drew attention to three other factors responsible for the growing amount of idle funds across Africa as indicated in Section 3.4.5. The first of these is the collection of what appears to be an arbitrary USF levy, the second is the time lag between money collection and disbursement, and the third is government bureaucracies that cause undue delays in decision and implementation process as indicated in Figure 12. Using arbitrary levies, as an illustration, Interviewee11 commented that the percentage of USF levy in many countries is randomly determined, with the implication that USF accumulate rapidly with regulators struggling to design projects fast enough to match the funds. Interviewee11 further added that it is not sufficient to design projects but that funds collected have to match identified coverage gaps otherwise if policymakers collect more than is needed, then the extra funds lie idle. The question that then arose from this discussion was 'what should be the right amount of levy for USF?'

[78] The head of one specialised access provider deploying mobile networks in disadvantaged areas in the region

[79] A USF specialist with over 15 years' experience across 17 countries in Africa

Interviewee11 suggested that what they found from designing various USF projects across Africa is that USF levy should not be above 1%:

> *We found, typically, as a rule of thumb, that regulators should not be collecting more than 1% of operators' revenue and anything above that is not just good.* Interviewee11.

Such an assertion was made following several years of planning and implementing USF projects for different countries in the region. This appears to be largely inconsistent with the findings from the country analysis in Section 3.4.3, where it was found that 21 (60%) out of 35 funds in Africa have USF levies above 1% with the highest at 5% collected in Mauritius and Tunisia. Interviewee11 underlines one of the issues that resonated from the country analysis of USF in Africa – a widespread accumulation of unspent USF lying idle without disbursement, which governments divert elsewhere. In addition to undermining the performance of USF as pointed out by interviewees, Figure 12 highlights that idle funds encourage corruption and fund diversion.

5.2.6 Corruption

The comments from seven interviewees highlighted that idle funds encourage corruption, which then undermines the implementation of USF in Africa as some government officials and USF administrators misappropriate the funds. The following quotes from two leading figures help to illustrate this point:

> *…unfortunately, we have to talk about corruption as these funds are being abused. I mean corruption is a problem that exists everywhere in the world and most certainly in places where people are paid very little to handle very huge sum of money…* Interviewee12[80]

> *…but the problem with our countries, given the weakness from the government perspectives, people see opportunities with these funds… So we find people managing these funds in a very subjective manner, therefore, corruption gets involved and the purpose is not met…* Interviewee13[81]

Interviewee12 added that, although corruption exists in every society, its high level across Africa, especially when it comes to the administration of public funds, is a cause for concern. Interviewee5 stated that even though money from USF are misappropriated and not made known to the public, it is generally accepted that it

[80]An access specialist and the director for business development of a niche provider

[81] A multinational MNO employee with a footprint across Africa in charge of public policy

happens and that this restricts the effectiveness of USF. Interviewee8 asserted that this is rather unfortunate considering that USF were established to address the telecommunication needs of the *"rural poor"* and not for satisfying the personal interest of policymakers.

Interviewee5 asserted that in an attempt to safeguard USF from corruption, *"excessive regulation"* might result - in terms of putting strict rules in place to make it very difficult for anybody to do anything with the funds. Further adding that policymakers might become extremely anxious not to be accused of misappropriation that they avoid disbursing the funds even for the right purpose. Interviewee 5 concluded that:

> *…corruption is an insidious evil here: if it doesn't do bad work, it makes it harder for anybody to do good work…*

The corruption concern raised by interviewees is consistent with Section 3.2.2, which argued that public sector deployment of subsidies in emerging markets generally lack accountability and, as such, subsidisation is susceptible to political capture and corruption. It was also suggested that corruption disrupts the operation of USF and deprive disadvantaged areas of the needed resource for coverage expansion. The suspension of the operation of USF in South Africa in 2011 following a series of corruption allegations, is one of the few documented examples in Africa (ITU, 2013b). Therefore, evidence from both the interviews and country analysis suggest that corruption poses a threat to USF and can be problematic to the campaign of improving digital inclusion owing to the mismanagement of funds.

5.2.7 Fund diversion

Apart from corruption, ten interviewees also suggested that idle funds could lead to fund diversion as USF are reallocated to serve other purposes. The following quotes help to support this argument:

> *There are a lot of funds being collected… but the problem is that the funds are being channelled to other areas to fulfill some short-term objectives of the politicians… They may be doing something good somewhere but they are not being used for the purpose they were created…* Interviewee23

> *…these funds end up on the balance sheet of the country and are used as assets to basically secure other loans. So they sit on the balance sheet of countries and they are unwilling to spend them because it makes them a little bit better…*
> Interviewee12

Interviewee7[82] emphasised that in countries where funds are collected and then transferred to the national treasury, no sectoral reform would ameliorate the conditions in disadvantaged areas if governments do not refrain from such practice. Figure 12 further illustrates that fund diversion has far-reaching consequences such as the award of low 'maximum' USF subsidy (see Section 3.4.4) and lack of project ownership and sustainability. Interviewee23 argued that since the diversion of fund limits the amount of money available for UAS projects, it creates a situation where policymakers indulge in under-pricing USF bids to the level that the execution and maintenance of network become unattractive and unstainable. Other interviewees commented that governments sometimes see USF as some form of tax revenue rather than using it to subsidise the expansion of telecommunications in needy locations. For example, Interviewee11 stated that:

> *Sometimes operators say, 'Oh we don't like funds, they are just taxing us and we don't want this' and I understand that because in some countries, they just take the money and they don't disburse it and that is a problem.* Interviewee11

The analyses in Sections 5.2.6 and 5.2.7 suggest that if idle funds are not diverted for personal use, governments can reallocate USF for other purposes. See Section 8.2.2 for the case of Kenya and Zimbabwe. This does not only limit the funds available to USF but also reduce the overall resources needed to help regulatory authorities discharge duties such as monitoring and enforcement. Consequently, Figure 12 highlights a complex link between idle funds, corruption, fund diversion, performance monitoring and regulatory capacity in the sense that where funds are misappropriated or diverted to other sectors, there is very little USF can achieve in terms of project execution and mobilising the regulator to monitor and enforce compliance.

5.2.8 Undue political interference

Eight interviewees agreed that another drawback limiting the implementation of USF in Africa is undue political interference by governments and politicians. For example:

> *From my experience as a regulator, some of the problems undermining the performance of the fund include political influence where government sometimes*

[82] A UAS expert and research who consults for the ITU, Word Bank and some countries in Africa

divert the amount collected towards another project entirely not related to telecommunications. Interviewee2[83]

... USF are politicised a lot. This is a big problem in Africa because sometimes, they host these funds at the regulatory body, sometimes a complete body is created completely out of the regulator and sometimes a different unit is set up under the ministry to manage the fund. In all these forms, government has a lot to say about it. Interviewee4

The above interview excerpts demonstrate that governments have the ability to alter the primary trajectory of USF to fit either their short-term interests or personal gains. The corruption case of the USF in South Africa (Section 5.2.6) and the diversion of USF in Kenya and Zimbabwe (Section 8.2.2) are some illustrative examples of this in practice. This suggests that regulators in such countries can become corrupt and subject to the influence of politicians, instead of being professional and free to perform their duties objectively. This supports the argument in Section 3.2.2 that subsidies are susceptible to political capture as those responsible for managing the process may abuse the system.

Figure 12 indicates that six interviewees commented that such practice would undermine the regulatory process and erode its independence as specified by respective enactments. Interviewee13 asserted that:

...we have a problem in Africa in terms of best practices that encourage the government to have independent regulators… whose position is not politically affected without fear or favour... If you look at the US – FCC, if you look at the UK – Ofcom… the effort is made. But what we find, in most of the cases in Africa, is that they put together a legal framework that makes the regulator basically a division of the department of telecoms or an office in the presidency. This means they will be… subjected to any form of political interference and put in question the objectivity of the sector.

Furthermore, Interviewee6 argued that if regulatory bodies were truly independent as enshrined in the law, their ability to implement USF and perform other regulatory functions should be free from the encumbrance of government and politicians as observed in certain parts of Africa. Interviewee5 also recounted that:

…there are possibilities where the fund will go to villages where the politicians come from in order to build political support for their return to office in the next elections.

Since regulators are afraid of losing their jobs, Interviewee5 continued, they simply comply even when they know that such decision is detrimental to USF. Evidence of

[83]A senior regulatory figure

this is illustrated in the case of South Africa where Mmatlou Morudu, a former executive manager of programmes at USAASA[84], alleged that he was dismissed from his position for failing to award a R500 million (about $47 million) contract to Cell C to upgrade networks in Emalahleni Local Municipality on the instruction of the ruling African National Congress (Bailey, 2014).

Apart from distorting USF allocation, undue political influence, according to Interviewee15[85], leads to the award of USF projects to players who do not have the 'means' to service disadvantaged locations. It was also suggested that this could result in the appointment/recruitment of unqualified regulatory personnel or people with the wrong skill sets, which could then subject the management and operation of USF to difficulties. Consequently, any attempt to formulate public policy to address market failure without accounting for the interests of those who are tasked with the administration and formulation of intervention would amount to little results (Section 3.2.3). This then raises the question of how to guarantee regulatory independence since the sector regulator and USF manager are part of the wider public institutions created, funded and run by the government. The response of Interviewee13 appears apt:

> *Obviously, you cannot have an institution that is separate from government but independence comes from the fact that the process that has been put in place to create that institution, appoint people to run that institution, does not allow government to give them direct instructions in terms of how they should run the sector…* Interviewee13

This suggests that 'true' regulatory independence comes from the fact that such institution should be empowered and set up in a way that no matter who comes to power, the decisions and operation of the regulatory body would be difficult to influence. The above analysis presents a complex, yet, interconnected web of issues. For example, the comments from interviewees indicate that undue political influence could be linked to corruption and fund diversion. Altogether, these three issues could also be linked back to inadequate regulatory capacity as shown in Figure 12, signalling a domino effect where one issue triggers another. Likewise, the lack of accountability and transparency, which is addressed in the next section, also reflects in this complex relationship.

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[84] Universal Service and Access Agency of South Africa

[85] A senior representative of one pan-Africa MNO

5.2.9 Lack of accountability and transparency

Figure 12 indicates that undue political influence also promotes a lack of accountability and transparency. Accountability and transparency here involve public availability and accessibility of up-to-date information relating to, for example, cash inflows and outflows as well as details of executed, on-going and planned USF projects. The correspondence from six interviewees, including Interviewee2, underline the argument that USF in Africa largely lacks transparency as their operations and management are obscured from the public even though USF is set up to serve public interest. For example, Interviewee5 stated that:

> *Another problem is a lack of transparency as a lot of these funds don't produce proper reports and although it is very much a matter of public interest but the public can't find out anything about it. And where they do produce financial reports, they are very much out of date…* Interviewee5

Evidence from the 34 funds surveyed as part of this study shows that although Lesotho, Nigeria, Rwanda and Tanzania are among the few examples of USF with publicly available financial records, such information is typically insufficient and/or outdated, with the exception of Uganda (see Appendix A and Section 3.4.5). The message here appears to be consistent with Estache and Wren-Lewis (2009) who found that institutions in emerging markets such as those in Africa are generally less accountable than developed countries and, as such, may be susceptible to the manipulation of governments and politicians.

Figure 12 indicates that countries where governments can unduly influence USF lack the political will and incentive to promote accountability and transparency. Similarly, such practice may also encourage corruption and funds diversion because if regular stewardship and reporting were to be allowed, it may help to forestall misappropriation of funds and deter the government from starving USF of its money. It then goes without saying that a fund that is more transparent in its dealings and accountants publicly for the money in its possession would be more likely to hedge itself against the influence of corruption and funds diversion, and contribute more to coverage expansion as illustrated with the case of Uganda in Appendix A and Section 3.4.5.

5.2.10 Lack of Interest from MNO

The evidence presented in Sections 5.2.5 to 5.2.9 aggregate to support the argument that, although a substantial amount of money is being amassed by various USF as indicated in Section 3.4.5, very little is invested into the extension of mobile coverage in disadvantaged areas. Six interviewees, including a regulator and a former executive of a multinational MNO, were of the opinion that in countries where the issues raised in Sections 5.2.5 to 5.2.9 are prevalent, MNO may be discouraged and lose interest in the whole process of digital inclusion. With respect to idle funds, for instance, Interviewe11 noted that:

> *…Sometimes operators say, 'Oh we don't like funds, they are just taxing us, we don't want this,' and I understand that because in some countries, they just take the money and they don't disburse it and that is a problem…* Interviewee11

If governments continue to collect USF without disbursement, this may discourage MNO from participating in the whole process of promoting digital inclusion since the money meant for implementing the process is being held back. See Section 8.2.2 for the case of Econet in Zimbabwe. When MNO become disinterested, this could also impinge on the ability of governments to collect USF levies, which some policymakers are already finding problematic. For example, when Interviewee2 was asked what were the challenges facing USF in their country, the comment was that:

> *From my experience as a regulator, one of the challenges of USF is trying to involve the operators, as they may not agree with the rules of engagements set by government… This leads to another challenge of trying to collect the money from operators at the end of each period*. Interviewee2

The [formal] 'rules of engagements set by government' highlighted in the aforementioned quote include the amount of subsidy allocated to USF project, which may be set very low as a result of idle funds, corruption and fund diversion. For example, Section 5.2.7 suggested that fund diversion might result in the under-pricing of USF bids to the level that the execution and maintenance of network become unattractive and unstainable. Interviewee23 commented that this hinders the participation of MNO in making bids for projects from the outset. Therefore, the concerns raised in Sections 5.2.5 to 5.2.9 can erode the trustworthiness of the campaign of digital inclusion and question governments commitment to providing telecommunication services for all. In jurisdictions where this happens, it becomes difficult for policymakers to gain the trust, cooperation, and contribution of MNO

towards coverage expansion. This is consistent with Section 3.2.2, which highlighted that this may result in the dysfunctional behaviour of market actors and detract the regulator from mitigating market failure.

Distinctively, three other interviewees, including Interviewee19, hinted that the lack of MNO interest in UAS is linked to basic economics, as areas perceived as less commercially viable would receive less attention and investment. For example, Interviewee23 commented that:

> *Operators also say 'oh it is a hassle going into such areas' as it is not so easy; hence, they also try to find the easy way, i.e., the deployment of telecom services in areas which are lucrative… So if the operators are much more profitable in bigger cities, then they naturally gravitate towards such locations as these companies were made for profits. They see rural areas as an extra burden, which doesn't bring much…*

This quote shifts the focus of the discussion to another theme: the lack of economic feasibility.

5.3 Lack of economic feasibility

Over half the interviewees, including a mix of regulators, consultants and researchers, stated that a host of complex and interconnected issues pertaining to the costs and benefits of network deployment would make an area either commercially viable or unviable. This, in turn, influences the investment decisions of MNO. For example, Interviewee1 noted that:

> *…it is simply a matter of economics that the existing technology used by the mobile network operators and the operational costs associated doesn't make it profitable for them to extend their networks into remote sparsely populated rural areas, and those areas bring their own challenges as well.* Interviewee1

Interviewee13 added:

> *You can't spend $6000 or $7000 a month* [OPEX] *on a site that gives you only $200.* Interviewee13

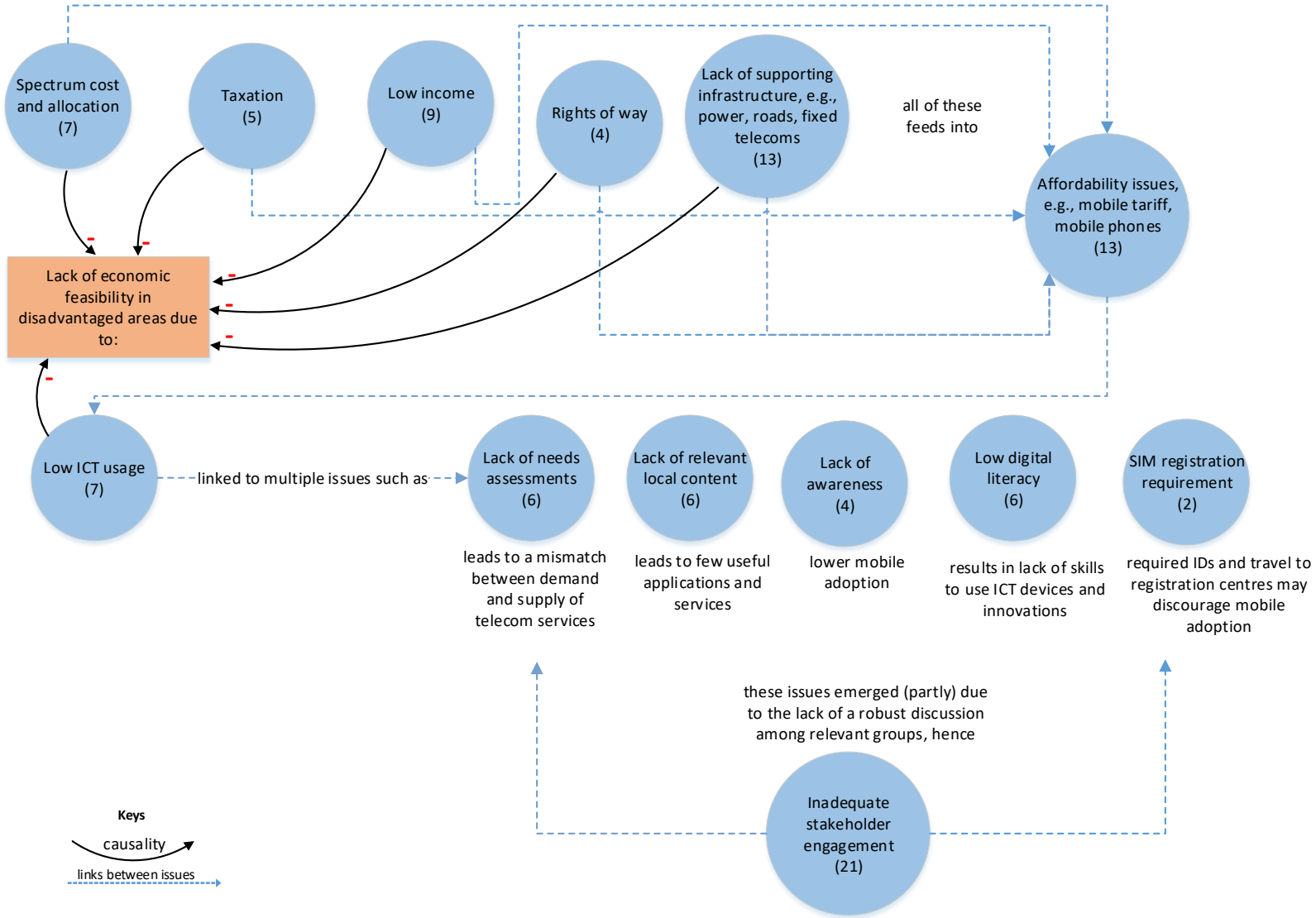
It, therefore, goes without saying that the prevailing lack of economic feasibility in disadvantaged areas is a major contributing factor to low mobile coverage in such locations and this is largely fuelled by prohibitive transaction costs[86], that is, a disproportionate level of costs relative to returns on investment. Hence, MNO only

[86] Transaction costs in this study means the costs of network deployment and maintenance (see Section 3.2.1).

have the appetite of improving coverage in commercial areas (Oiteno, 2018). This appears to have stalled the expansion of mobile coverage across Africa as evident in the 500 million odd mobile connections generally reported and particularly illustrated with the case of Kenya where over 10% of the population has remained unserved since 2013 (Collins, 2015; Dorward, 2013; GSMA, 2016b; 2017b; ITU, 2013b; Manson, 2013; Otieno, 2018). The market failure of uneven mobile coverage can thus persist when the costs of deploying and maintaining infrastructure surpass the benefits derived (Section 3.2.1). This is further reinforced in a recent study by the ITU where Lehr (2018) asserted that *"the social and economic adjustment costs of responding to the forces of digital transformation are significant and may exacerbate inequalities between haves and have-nots".*

Unlike the complex data map in Chapter 4 (Figure 11), Figure 13 provides a focused version that shows a more nuanced interaction between the issues related to this theme.

Figure 13: Lack of economic feasibility



5.3.1 Rights of way

The starting point of the argument raised under this theme revolves around the costs of network deployment and maintenance vis-à-vis and returns on investment, which feeds into business sustainability. Regarding costs, four interviewees, including Interviewee2, revealed that the costs and difficulties of obtaining rights of way in some parts of Africa further add to the discontentment of MNO from participating in coverage expansion. For example, Interviewee23 said that:

> *Rights of way is a big issue, especially, when you are outside the cities. First of all, to get the right of way from the government is a big hassle and if you have to pass through a private land, the owners will ask for money. All these make it difficult to lay a fibre or erect a tower in such places because the moment they find out that it is a telecoms company, they say 'ah okay, that means money.*
> Interviewee23

Interviewee18[87] added that from their experience in facilitating rural telecommunications projects in Africa, operators always say that their *"biggest problem"* is land acquisition and environmental issues. According to the interviewees, rights of way in telecommunications not only provide operators with the needed land and/or space to deploy physical network infrastructure such as towers and cables but also encompass the ability to obtain environmental approval from relevant agencies. They further suggested that such land and space are usually not owned by the MNO, hence the need to negotiate costs of acquisition or lease with landowners and host communities. Furthermore, the installation of new sites, more often than not, requires some sort of clearance from environmental agencies. It came across from interviewees that, not only is it costly to obtain a concession to use public and private lands, but negotiating and obtaining an environmental clearance is also complicated and fraught with difficulties, which adds extra costs to network deployment.

Juxtaposing this with the prevailing low-income in countries such as, for example, Burundi, Madagascar and Togo (World Bank, 2018c) and the legacy problem of lack of supporting infrastructure (Section 2.2), over ten interviewees, as indicated in Figure 13, argued that the resulting ARPU may not be enough to sustain network operations. As such, MNO would see no economic justification to expand coverage into such locations. Evidence from the country analysis further strengthens

[87] A regulatory specialist with an international lending organisation who is working with countries in Eastern Africa to improve coverage in disadvantaged areas

this argument. For example, the Executive Vice-Chairman of the NCC, Professor Umar Danbatta, echoed this sentiment saying that the demand for the issuance of rights of way from states and local government across Nigeria is one of the factors threatening the expansion of mobile networks in the country (Adepoju, 2016b).

5.3.2 Spectrum costs and allocation

Another area that tends to exacerbate the transaction costs of network deployment is frequency spectrum pricing and administration. Unsurprisingly, of the seven interviewees that shared this sentiment, MNO were particularly vocal. Perhaps this may be due to the critical impact spectrum has on the success of mobile telecommunications and the fact that it is a limited resource with an increasing demand (ITU, 2007; Curwen & Whalley, 2010; Song, 2016a). Interviewee13 stated that:

> *…cost of spectrum is priced beyond any business plan… We had an instance in* *** [a country in Africa] *where… they wanted to sell 4G LTE spectrum on auction and the reserve price was around $62 million. Now when you do a business plan, you realise quickly that you cannot get that money back as it is simply too expensive.* Interviewee13

Recounting their experience in the region, Interviewee18 and Interviewee23 also added:

> *On the other hand, this* [spectrum auction] *was acting like a barrier as only big operators… can participate in these auctions. Ordinary businessperson or entrepreneur can never participate because the minimum base price to enter these auctions is like hundreds of millions of dollars…* Interviewee18
>
> *…considering the high costs of deployment, why would government and regulators still fix a high price for spectrum?* Interviewee23

The responses from interviewees suggest that policymakers in some parts of Africa set spectrum prices that do not reflect the socio-economic conditions in respective countries considering that MNO will need to spend 'significant'[88] amount of investment on supporting infrastructure like electricity and roads as recounted by 13 interviewees in Figure 13. For example:

[88] For example, the cost of running a typical BTS (base transeiver station) in African countries like Malawi and Zambia takes up to 40% of the overall network opex with about 13 litres of diesel needed to power a single site and nearly half of the over 240,000 BTS across Africa are deployed in off-grid locations (Malakata, 2015; Kumar, 2014). Therefore, MNO need to deploy electricity alongside networks (Deloitte, 2014; Lerner, Fukui, & Gallegos, 2017).

… if you pick countries where other kinds of infrastructure… are poorly developed such as road, rail, power, it just adds significant expense to the mobile network operator… Interviewee1

Interviewee17 added:

So if anyone is thinking about extending coverage, they should think carefully about the conditions they attach to spectrum licence.

These interviewees were unanimous in their assertion that the lack of supporting infrastructure, significantly electricity, coupled with spectrum prices further increase the overall transaction costs of network deployment and maintenance. This makes it harder for both small and large players to recoup their investment, especially in areas perceived as commercially unviable. Table 9 below illustrates some examples of spectrum pricing across Africa.

Table 9: Examples of spectrum pricing across Africa

Country	Year of auction	Spectrum awarded	Amount
Algeria	2016	4G LTE Mobilis for DZD 5 billion Optimum Telecom Algeria for DZD 4 billion Ooredoo for DZD 2 billion	 $45.9M $36.3M $18.1M
Egypt	2016	4G spectrum licence initially offered at After rejection from MNO, a new offer was made as follows: 4G LTE licence with 20MHz to Orange 4G LTE licence with 5MHz to Vodafone 4G LTE licence with 10MHz to Etisalat	$806M $484M $37M $60M
Ghana	2015 2017	2x10 in 800MHz 4G LTE licence	$67.5M $67.5M
Kenya	2016 2018	800MHz for Including obligation to share 30% capacity with smaller operators 4G LTE licence in the 800MHz band	$25M each to the three MNO – Airtel, Orange and Safaricom $25M paid by Airtel Kenya
Niger	2018	4G licence issued to Airtel	$22M
Nigeria	2007 2013 2016	Four blocks of 10MHz paired spectrum in the 2GHz band for 3G services at One slot of 30MHz in the 2.3GHz band One slot of 2x5MHz in the 2.6GHz band (with a total of 14 slots)	$150M each $23M $16M
Senegal	2016	4G spectrum licence	$51M
South Africa	2016	600, 700, and 800 MHz bands	$200M each

Source: Compiled by author from a variety of sources

It can be observed from Table 9 that different spectrum prices apply across Africa, sometimes substantially so. For example, 800MHz is offered for $200 million in South Africa while Kenya offers the same band for a significantly lower amount, albeit with an obligation for the three main players to share 30% of their network capacity with smaller providers. Furthermore, the three main players in Egypt initially refused to apply for 4G LTE licence offered by the regulator in the last quarter of 2016 because of the asking price, which they argued would make their business plans commercially unviable. The CEO of Vodafone Ghana, Yolanda Cuba, also shared this sentiment arguing that the $67.5 million set by NCA[89] for a 4G licence as indicated in Table 8 is too 'high'. Yolanda asserted that, although MTN, who also complained about the price, had acquired the licence, Vodafone would only do so when NCA offers a price that is economically viable to its business and customers (Lokko, 2017). Despite such concern, NCA appears unwilling to lower the price as the Communications Minister, Ursula Owusu, said, "*there is no way we will go below that amount* [$67.5 million]…"

Furthermore, interviewees also highlighted that the decision-making process around spectrum administration appears to be fraught with inconsistency and uncertainty, and that such practice makes it difficult for MNO to project and plan for future expansion. This was amplified in the response of Interviewee1 thus:

> *I think the other problem that has emerged is that spectrum has gone from a relative surplus to apparent scarcity. I say apparent because I think there is spectrum available but it is a kind of administrative scarcity as opposed to a tangible or physical scarcity… So, generally across the continent, we have seen very, very slow release of new spectrum to operators…* Interviewee1

This suggests that spectrum allocation policy in some parts of Africa could be deficient in terms of delays and creation of scarcity. According to the Group Chief Technology Officer of MTN, Babak Fouladi, when policymakers delay spectrum allocation, it limits the ability of MNO to rollout network and extend services (Mamabolo, 2016). Also see Section 8.2.1 for the case of South Africa where an impasse between sector ministry and the regulator has led to an 'indefinite' postponement of spectrum auction and allocation for bands 700MHz, 800MHz and 2600MHz.

[89] National Communications Authority

5.3.3 Taxation

Concerns were also raised about the prevailing system of taxation in the sector. Five interviewees indicated that the tax burden on the sector is an issue of concern in terms of the rates and multiple charges across countries. The response from Interviewee13 underline this argument thus:

> *The tax pressure is extremely high and increasing by the day. You have the general tax, the income tax, and then you have what we call telecoms-specific tax, inbound tax, SIM cards import, handsets, tax on literally everything… why would you, in a place where service is so expensive and penetration is so low, impose a tax on handsets importation, for example?* Interviewee13

Interviewee17 added that government actions like taxing mobile devices and other telecommunications equipment appear puzzling considering that regulation ought to be driving down the transaction costs of getting people connected as low as possible to mitigate market failure. Interviewee17 argued that such practice has the tendency of undermining the success that has been recorded in the sector post liberalisation. This echoes the view in Section 3.2 that government intervention should not only focus on promoting equity but also stimulate economic efficiency. Triangulating the responses of interviewees with the secondary evidence from the literature and country analysis, Table 10 highlights some examples of sector-specific taxes across Africa.

Table 10: Examples of mobile telecoms related taxes across Africa

Tax	Country example	Comment
Airtime tax	Airtime is applicable in 12 countries in Africa. For example, 10% in DRC, 18% in Gabon, 3% in Niger, 10%, 10% in Kenya and Tanzania, 12% in Uganda, etc. A flat rate of $0.06 is applicable in Angola Zimbabwe: $0.5 levy on every $1 worth of airtime and mobile data top-up Algeria increased airtime tax from 5% to 7%	
Corporate tax	Cameroon: 39% on MNO compared to 25% standard rate Tunisia: 35% on MNO compared to 25% standard rate	This tax is levied on organisations' profits, but from the data, it is clear that MNO are taxed higher than the standard rate applicable to non-telecoms organisations. According to Deloitte and GSMA, average telecoms tax rate in Africa and Asia (just below 30%) is the highest globally while Latin America and Europe lag behind at 25% and under 25%, respectively.
Customer duties	Gabon: $5 flat rate on imported handsets Madagascar: 1% tax on imported handsets Mozambique: 7.5% tax on imported handsets Nigeria: 12% customs duty is charged on imported handsets Zambia: 5% tax on imported handsets	
VAT and excise tax	Angola: 5% VAT on basic telecom services – voice and SMS. Another 5% is applied to advanced services like data (10% standard rate) Egypt: 15% VAT on mobile services (10% standard rate) Lesotho: 5% apiece for both basic and advanced telecom services (14% standard rate) Tanzania: 10% excise flat rate on telecom services Uganda: 10% and 20% excise on basic and advanced services, respectively (18% standard rate) 5% VAT currently applies in Nigeria. Additional 9% telecom service bill is being considered by the National Assembly in a country where data affordability is a major concern and internet penetration is still low Algeria increased VAT on mobile services - from 7% to 19% on data and 17% to 19% on voice	The value-added tax (VAT) is typically applied to the final goods and services of consumers. While some countries apply a flat and sometimes higher VAT on telecom services, others apply different rate on basic and advanced services.
Sector-specific consumer tax	Gabon: $5 flat rate is applied to handsets sale Ghana: 20% handsets tax	Some countries in Africa levy consumer tax on mobile devices in addition to VAT
Sector-specific MNO tax	Tanzania: 12% tax is applied to MNO revenue South Sudan: exercise duty on telecoms services increased from 10 to 15% in 2018	

Tax	Country example	Comment
Other taxes	Nigeria: MNO pay other taxes to local and state governments Kenya: 10% flat rate is applied to mobile money transactions Tanzania:10% flat rate on mobile money transactions Uganda: 10% tax applies on mobile money transactions and 14% is applied to revenues that accrue to MNO from mobile money 20% SIM cards tax is applicable in Nigeria	In Nigeria, these non-standard taxes are coined in different names like environmental taxes, etc.

Source: compiled by the author from a variety of sources.

Table 10 clearly helps to establish the veracity of the claims made by interviewees. Not only is the sector subject to relatively higher corporate taxes than the standard rates, the industry is also subjected to multiple taxes. For example, the standard corporate tax rate in Cameroon is 25% in contrast with 39% on MNO as indicated in Table 10. Of particular concern is the effect of such taxes on services and transactions of small denominations, which are typically generated by low-income earners. For example, a significant number of suburban and rural dwellers who do not have access to traditional banking infrastructure across Africa use mobile money (Abdella, 2017; World Bank, 2015). At the end of 2014, the value of mobile money transactions was over $45 billion across Kenya, Rwanda and Uganda, an equivalent of 32% of their combined GDP (GSMA, 2016a). Across these three Eastern African countries, 10% tax is levied on mobile money transactions as shown in Table 10. The comments of interviewees suggest that this has the tendency of limiting the adoption of such mobile services as taxes are reflected in charges offered by the MNO. This is consistent with studies (GSMA & Deloitte, 2015; GSMA, 2017c) that found that taxes on mobile money in Eastern African countries like Kenya, Tanzania and Zimbabwe come with the consequence of excluding people from digital financial inclusion.

Apart from such taxes, there is also pressure from various government agencies who impose series of charges on the industry. This can be illustrated with the case of Nigeria where IHS, a towerco, is in dispute with three states in the country (Cross River, Enugu and Kogi) over 'illegal' charges (Akintaro, 2018). The Kogi State Fire Agency is demanding *"safety charges"*, Enugu State Waste Management wants payment for *"effluent discharge permit fee"* and the Cross River State Infrastructure Safety and Regulation Agency is asking for evidence of state *"permits and approval"* before HIS can deploy infrastructure (Akintaro, 2018). The NCC is currently trying to intervene in the issue since IHS has legally obtained its licence and paid the relevant fees to the regulator.

Such charges and taxes could be absorbed by market actors with the consequence that it affects their ARPU and discourages further investment, or the burden may be shifted to subscribers and limit service usage with a wider negative impact on the sector (Afadhali, 2016; GSMA, 2016a; Tredger, 2014). Furthermore, it is interesting to note from Table 9 that Eastern African countries have the highest cumulative rate of telecommunication taxes and the least mobile penetration region in

Africa as indicated in Chapter 2. Interviewee13 also asserted that multiple taxes could also impinge on the affordability of mobile devices and services as vendors and MNO would more likely shift the tax burden to the consumers as indicated in Figure 13. Where this is not possible, the industry may end up neglecting such areas altogether resulting in market failure that stems from incomplete market as explained in Section 3.2.1. This leads to the next discussion on affordability.

5.3.4 Affordability barriers

Affordability is one of the fundamental principles for achieving UAS as argued in Section 3.3.1. To recount, it refers to the ability of everybody to pay for telecommunication services regardless of location and income level. Figure 13 indicates that the issues raised in Sections 5.3.1 to 5.3.3 aggregate to exacerbate high costs of network deployment and maintenance, which then feeds into affordability in terms of the ability of end-users to purchase mobile devices and pay for mobile tariffs. Take taxation (5.3.3), for instance, the response from Interviewee13 appears apt:

> *Now, what that does* [tax pressure] *is that it puts pressure on the viability of the business and as a business, since we are not NGOs, we can only pass that on to the customers and this makes the service a bit more expensive and it does challenge the affordability… This also does not help in terms of incentivising operators to invest enough.* Interviewee13

Over 50% of interviewees voiced their unease on this issue, an indication that affordability is one of the major explanations of the digital divide in Africa in terms of limiting mobile adoption. This is consistent with Section 2.4, which highlights that affordability is one of the causes of digital divide. The discussion of affordability is broken down into mobile tariffs and cost of mobile devices as examined below.

5.3.4.1 Mobile tariffs

There was a general consensus among seven interviewees that although mobile tariffs, particularly for voice, have declined compared to what prevailed during the early stage of market liberalisation, but the same cannot be said of advanced services like data. Interviewee5 and 16[90] were quite vocal on this.

> *…they* [MNO] *should be providing telecom services…at affordable cost and perhaps with a graded fee structure to make small transactions very inexpensive…* Interviewee5

[90] A senior figure of a civil society organisation with over 20 countries

I don't think they [MNO] *should expand – they provide too costly an option for most rural Africans…* Interviewee16

These comments emanated when the interviewees were asked to suggest ways to encourage MNO to expand into disadvantaged areas. Other interviewees added that:

…people perceive the need but there is affordability problem where they fundamentally do not have income to subscribe to these services. Interviewee17

…affordability is also an issue because even if people are somehow not faced with the first three problems I have discussed, they may not be able to pay for it as the tariff, particularly for broadband is more expensive than voice. Interviewee23

Interviewees further suggested that affordability of mobile tariffs is not only a major challenge for people in suburban and rural areas across Africa, but also for low-income earners in urban areas, especially when the cost for data subscription is included. For further triangulation, Table 10 highlights tariff bundles[91] using some examples across Africa in contrast with OECD Telecommunications Price Baskets[92], which offers valuable means of assessing and comparing the tariffs 'experienced' by subscribers across OECD countries (OECD, 2017).

[91] This is a tariff strategy whereby MNO offer one or more telecommunication service as a package to end-users, that is, voice, SMS, and data services as a single price offering (Research ICT Africa, 2014; Telecoms Pricing, 2014). For example, a bundle may consist of a given number of minutes for voice calls, SMS and/or allocation of a given unit of data all in one tariff plan.

[92] OECD Telecommunications Price Baskets is a methodology that pulls together the prices of telecommunication services – bundles - offered by operators to calculate the average tariff paid by subscribers across OECD countries (OECD, 2017).

Table 11: Examples of tariff bundles across Africa

Country	MNO	Bundle offering	OECD Price Baskets ($)	Cheapest country offering ($)
Angola	Movicel	Voice, SMS, data	25.68	19.84
Egypt	Mobinil Etisalat Vodafone	Voice and SMS Voice and data Voice	13.01 6.94 6.94	2.77
Cameroon	Orange	Voice and SMS	8.40	8.40
Kenya	Orange Airtel	Voice and SMS Voice and SMS	3.52 2.39	1.47
Tanzania	Airtel Tigo Vodafone Zanzibar Telecom	Voice, SMS, data Voice, SMS, data Voice, SMS, data Voice and SMS	6.40 6.41 9.60 19.19	6.40
Namibia	Telecom mobile MTC	Voice, SMS, data Voice, SMS, data	8.05 12.71	8.05
Nigeria	Glo	Voice and SMS	6.12	4.49
South Africa	MTN Cell C	Voice, SMS, data Voice, SMS, data	91.98 91.98	4.85

Source: Research ICT Africa (2014).

From the eight examples provided in Table 11, the mobile tariffs of bundle offerings in five (Angola, Egypt, Kenya, Nigeria and South Africa) countries are higher than the cheapest offering. For instance, the bundle offering by Glo in Nigeria is 1.3 times[93] higher than the cheapest country offering while it is 19 times[94] higher in South Africa. However, the trends in Cameroon, Namibia, and Tanzania show a mixed picture, as mobile tariffs of bundle offering are equivalent to the cheapest country offering. Table 11 thus highlights the concern raised by interviewees that the affordability of mobile tariffs in some parts of Africa remains a challenge, especially in relation to average earnings in the continent, which is $1000 or less per capita annually than in the rest of the world (Anderson, 2016). For example, Malawians spend over $12/month on mobile services, an equivalent of more than 50% of an average monthly income in the country and up 22% among rural dwellers in South Africa (ITU, 2014; Gilbert, 2016b). This is in stark contrast to the 5% recommended by the UN (A4AI, 2017b; ITU, 2013a). Consequently, although the introduction pricing strategies like bundling have contributed to driving down prices, the mobile

[93] 6.12/4.49 = ~ 1.3

[94] 91.98/4.85 = ~ 19

tariffs being offered are still very high or at the very least, limit the rate of mobile adoption for data related services (Katlic, 2014; Telecoms Pricing, 2014).

5.3.4.2 Cost of mobile devices

According to five interviewees, another way affordability challenges mobile coverage and adoption in Africa is the cost of mobile devices. Interviewee17 stated that:

> *…another big piece is the affordability issue, which includes the cost of devices…Historically, in many of these countries, it has been difficult to get low-cost devices that really have good data connectivity because having the user interface, the battery power and so forth to support data usage adds a lot of cost to the device…* Interviewee17

Interviewee22[95] added that the high cost of mobile devices, especially smartphones[96], is a major barrier to mobile penetration and adoption among the rural poor. Overall, the responses from interviewees suggested that the affordability of smartphones is a very critical issue in the campaign of digital inclusion because the demand and use of data are fast becoming more important than it was a few years ago before the advent of mobile applications and social networks. Smartphones are fast becoming the platform of choice for accessing these advanced services and applications, which are increasingly becoming critical socio-economic enablers (Manson, 2013; ITU, 2017a).

The proliferation of second-hand and low-cost smartphones from advanced countries in Europe and North America as well as emerging markets like China and Taiwan have increased across Africa by 20% between 2013 and 2015 (GSMA, 2015a). However, contrasting that with the world average of 40%, one can understand the argument made by interviewees that more needs to be done to close the gaps in smartphones affordability in Africa. The case becomes even more compelling when the average price range for low-cost smartphones in the continent, which is between $100 and $50, is compared to the prevailing $1000 or so per annual capita income

[95] A long-term academic and UAS expert

[96] These are high-end mobile phones with advanced computing capabilities, execute an identifiable OS such as Android, Windows, iOS, allow for multiple and fast connectivity to GSM, Wi-Fi, etc., and allow third party application installation from app centres (Donovan & Martin, 2012; Theoharidou, Mylonas, & Gritzalis, 2012)

(Anderson, 2016; GSMA, 2015b). As a result, feature phones[97] adoption has increased in Africa from 55% in 2016 to 60% in 2017 while smartphones adoption fell from 45% to 40% in the same period, driven by the activities of Transsion, a Chinese low-cost manufacturer (Balancing Act, 2018c). This indicates that the cost of smartphones is still a lot of money for low-income earners who form a bulk of Africa's population (World Bank, 2017).

Evidence from the data suggests that the cost of smartphones, especially for low-income earners, can be partly linked to the tax policy in the sector, for example, Interviewee13 asserted that:

…Why would you, in a place where service is so expensive and penetration is so low, impose a tax on handsets importation? …we can only pass that on to the customers, this makes the service a bit more expensive, and it does challenge the affordability.

Interviewees agreed that tax policy such as charging 'high' or multiple duties on the importation of smartphones would lead to increase in the prices offered by vendors, making the cost of smartphones more expensive. This could then act as a disincentive for the industry to expand coverage in the sense that mobile adoption by end-users could be restricted by their inability to afford mobile devices. This indicates that a complementary segment of the market is missing, which could result in a market failure that stems from a missing market as highlighted in Section 3.2.1. This raises the issue of mobile adoption and usage as examined in the next section.

5.3.5 ICT adoption and usage

This section explores the benefit component accruable to MNO by looking at various factors that influence mobile adoption and usage, which then impacts on ARPU and returns on investment. According to Interviewee17:

The economics of mobile network deployment is all about the cost of providing the network relative to the revenue you can earn. The difference between urban and rural areas, fundamentally, is that in rural areas, the costs are higher particularly in Africa since you may need to cover a bigger area as there are fewer people in terms of the density of usage… Interviewee17

[97] These are low-end mobile phones with low bandwidth connectivity or limited computing capacities, hence, cannot not run operating system (OS) or at the very least, run limited OS such as Android, Windows, and iOS (Donovan & Martin, 2012; Theoharidou, Mylonas, & Gritzalis, 2012).

This suggests that when MNO plan the expansion of telecommunications infrastructure, they typically focus on the costs of providing the network relative to accruable benefits in terms of revenues that stem from adoption and usage. This is consistent with the argument in Section 3.2.1 that, it is the comparison of the revenue arising from adoption and usage relative to costs that inform the investment decision of a given location. Seven interviewees stated that the existence of low ICT usage is noticeable in disadvantaged areas across Africa and that this results in low mobile adoption. Two interviewees commented thus:

> *Another factor is that there seems to be no intensive use of ICT in rural areas… hence less need or demand by rural inhabitants.* Interviewee2

> *We took smart handsets with a lot of data and gave it to a group of people in some villages and after a month, we realised that they did not use the data… Because they did not know what to do with all the data we gave them. I am sure if I were to give it to you* [the interviewer], *you would access content, you would access movies, you would do research because you have the knowledge to use the data.* Interviewee13

In countries where such condition prevails, interviewees asserted that MNO may be dissuaded from expanding coverage into such areas due to the perceived low demand and adoption of telecommunication services. In all, evidence from the data suggested that low ICT usage does not exist in isolation but linked to multiple issues as shown in Figure 13 and outlined below.

5.3.5.1 Lack of digital literacy and awareness

Six interviewees, including two regulators and one multinational MNO employee, argued that both policymakers and MNO are not doing enough to promote digital skills and educate end-users on how to use technology**.** Two interviewees asserted that:

> *Although mobile penetration has increased significantly in **** [the name of a country in Africa], *however, there are still some challenges to address, for example, the high level of digital illiteracy among rural population…* Interviewee10[98]

> *…lack of awareness is also a problem, as people don't fully know the benefits that accrue from using telecom services such as broadband… They don't even know, for example, what learning they can do from the internet, how they can improve their crop yield that they can limit the rate of animals falling sick, on which their livelihood depends…* Interviewee23

[98] A USF director

The above interview quotes would suggest that apart from not doing enough to promote digital literacy, the same is true when it comes to informing a given community on what telecommunication services exist and the importance of such services to their daily lives. Interviewees further suggested that since little attention is given to digital literacy and awareness creation in general, the adoption and use of mobile telephony, as well as other ICT, might not be as popular as it should be. This is consistent with the argument in Section 2.4 that there may be instances where network is available but people may not use them due to a lack of awareness and digital literacy, which then contribute to digital divide. Interviewee23 quoted above added it is the responsibility of policymakers to lead the campaign of awareness creation in collaboration with other stakeholders in the industry. When awareness is created, it stimulates demand and MNO would most likely go and spread telecommunication services when they know that people would use their services with or without USF.

Section 3.3.1 indicated that it has long been argued in the literature (for example, Blackman, 1995; ITU, 2013b; Oestmann & Dymond, 2008) that availability, accessibility and affordability are the three underlying principles that a viable UAS policy should reflect in order to close the digital divide. However, evidence from the data also shows that a lack of awareness that encompasses digital literacy can equally challenge the achievement of UAS. For example, it not sufficient to provide affordable access to telecommunications when people do not know how to use technology or the importance of the services provided. This goes to suggest that in light of the constant advancement in technology and services, ignoring awareness creation may push back the achievement of UAS as this reflects in low mobile adoption and usage. Therefore, there is need to extend the principles of UAS to include awareness in order to ensure that people become aware of the importance of new technologies and educated on how to use them as they evolve (Section 3.3.1).

5.3.5.2 Lack of needs assessments and relevant local content

Another factor advanced by interviewees that is responsible for low mobile adoption and usage is the lack of needs assessments. This involves having a clear knowledge of what the relevant telecommunication needs of a given community are. Six interviewees were particularly vocal on this point, with, for example, Interviewee11 noting that:

We often find that people operating in these areas don't know what the actual gap is and then it is difficult to discuss solutions or to discuss what needs to be done when you don't know exactly what is the problem and how big it is, what would it cost to close the gaps and where in the country are the gaps? Interviewee11

In addition to this, Interviewee17 added that in disadvantaged areas, it appears that nobody really knows what the 'real' problems are, as all that exist seem to be different opinions. If there is low mobile penetration and adoption, Interviewee17 asked, do we understand why that is? Just having poor coverage in an area, insisted Interviewee24[99], is not in itself an expression of need, there are local sensitivities and different levels of needs that require consideration to address the digital divide of uneven mobile coverage a given area. It came across from the interviews that although policymakers and MNO often assume they know the telecommunication needs of an area, but practice would suggest otherwise. For example, Interviewee17 asserted:

One of the things that should be done to achieve a better result with USF is, before anyone even thinks of disbursing any fund on actual projects, they should spend a small amount of money on really understanding what is really the access gap? What is the problem? People always assume they know what the problem is and that all the money should be spent on the answer but going back to one of the things I said before, is the problem really coverage? Do the government and the regulator really know what coverage is in these areas? Is it changing all the time? Interviewee17

This argument was further highlighted in the data where Interviewee13 said they assumed that affordability was the reason why a given community was not demanding more data. Hence, the MNO decided to give free smartphones preloaded with data to a selected number of people in order to see if that would stimulate demand. Surprisingly, after a given period, the users did not consume a large part of the data. Why? The multinational MNO responded:

…because they did not know what to do with all the data we gave them… So we realised that giving them handsets with data is not the solution. There were dimensions that needed to be added: relevant content and education… Interviewee13

The multinational MNO in question obviously assumed that affordability was the only telecommunications need in the community, but in hindsight, it turned out that a lack of digital education and relevant local content were part of the puzzle. Figure 13 indicates that a lack of need assessment may lead to a mismatch between demand and supply of telecommunication services and, in turn, result in low mobile adoption and

[99] An academic and UAS consultant

usage. Although Interviewee13 asserted that the lack of relevant local content and digital literacy were the reasons why the project failed, one can only know, for example, the relevant content to provide when the actual needs of a group of people are known. Therefore, the starting point is needs assessment. Since it is arguably impracticable to replicate the strategy adopted by Interviweee17 across all disadvantaged areas considering the level of resources that would be needed, Interviewee24 suggested that:

> *...some country research needs to be done to know where the true needs are. It is important for the government to do this because they need to see the reason why operators choose certain cities and not the other city, know what is lacking in such places...* Interviewee24

Interviewees23 and 24 further added that needs assessment is the task of the governments, as MNO will most likely do this for only commercially viable areas. Therefore, policymakers need to take the responsibility and invest in some market research to know what the relevant telecommunication needs are and deploy USF accordingly. This reinforces the argument in Section 3.3.1 that for UAS to fully address the digital divide in this current information age, it is critical to include assessment as part of the underlying principles of UAS.

5.3.5.3 SIM card registration requirements

Two interviewees were of the opinion that the conditions attached to SIM card registration[100], especially the required means of identification, is acting as a barrier to mobile adoption and usage:

> *...some of the barriers to increasing penetration include…the difficulty in getting the subscription itself in terms of where many countries have a sort of onerous registration requirements before you can actually get access to a mobile service. For example, the provision of ID, this is not available in some rural communities.* Interviewee21[101]

Interviewee17 added that SIM registration and aggregation of usage do not sit well together in the sense that government can say they want it but they also have to consider the wider socio-economic impact of such a policy. For example, although the lack of a valid means of identification may hinder SIM registration for urban areas as

[100] This refers to regulatory mandates, which require MNO to register the identity information of individuals before activating their mobile SIM (Donovan & Martin, 2012).

[101] A former multinational MNO figure responsible for public policy.

well, the impact of this is more severe on those in the rural areas who may need to travel to the city where government institutions responsible for issuing such valid identifications are located. Apart from the fact that embarking on such a journey comes with an extra financial and time burden, some of the people living in such areas may not have other needs for these identifications.

The growing trend of mandatory SIM card registration across Africa has not gone unnoticed with governments arguing that the exercise is necessary to address national security concern and the criminal behaviour of individuals (Donovan & Martin, 2012; GSMA, 2013a; 2016; Africa Research Bulletin, 2017). This is fast becoming part of the obligations of MNO in Africa so much so that 49 of the 55 countries in the continent have mandated it or are in the process of doing so (Gillwald, 2015). Although Malawi recently suspended this exercise due the disquiet of state spying and long queues for registration (Balancing Act, 2018b), it also raises the issue of policing, which puts extra strain on regulatory capacity. The enormity of the issue can be observed in Nigeria where MTN was fined $5.2 billion for failing to disconnect 5.2 million unregistered SIM cards in 2015 (Africa Research Bulletin, 2016; Prinsloo & Ibukun, 2016). After eight months of litigation and negotiation, NCC and MTN later settled out of court with MTN agreeing to pay $1.7 billion over three years (Prinsloo & Ibukun, 2016).

Although the purpose for the introduction of SIM registration has been associated with national security, interviewees suggest that the inability of those living in disadvantaged areas to secure the required means of identifications serves to limit mobile adoption and usage. In many ways, the fault is not theirs but a reflection of national conditions in certain countries in Africa where there is a lack of a national identity database. Interviewees17 and 21 suggested that it imperative for policymakers to allow some form of flexibility for SIM registration, especially for people in rural areas.

5.3.5.4 Inadequate stakeholder engagement

There was a general consensus across 21 interviewees that a major contributing factor to issues discussed thus far largely stems from inadequate stakeholder engagement as highlighted in Figure 13. Drawing upon the comments of interviewees, this refers to a situation where there is an inadequate representation of a diverse and relevant group

of stakeholders in UAS debate and their wider implications on the society. Such group should include MNO, equipment vendors, towerco, civil society, local communities and the emerging OTT. Interviewees argued that in countries where there is a lack of engagement, not only would the issues outlined in Sections 5.3.1 to 5.3.5 result, but the overall impact of USF could be limited as well. The following quotes from interviewees help to support this argument:

> *…one of the things that are missing in many countries is an ongoing multi-stakeholders' dialog on the importance of communication, broadband and infrastructure to their country. So very often you find that government is not in dialog with industry and neither of them is talking to civil society or they are having bilateral communications which are not including other important stakeholders…what you want is an ongoing forum where issues can be raised and dealt with before they become a debilitating crisis in a country.* Interviewee1

> *…I think in countries where USF have not been successful, government should be willing to sit down with other stakeholders to evaluate the framework of USF, particular where the funds are there, after all, these monies are from operators and their subscribers… I do think it will make sense to create a discussion…* Interviewee4

> *I think that cooperation has to happen. I think that something as complex as USF takes a lot of capacity in the regulator to do well… You, therefore, need a sharp, skilled and powerful regulator to stand up, cajole, and work with their counterparts including the MNO.* Interviewee19

It was suggested that to get more from the implementation of USF, there has to be a transparent consultation process that involves a wider circle of representation from various interest groups. Such consultation, insisted Interviewee21, should not be a 'one-off' event but a continuous process because as market and technology continue to evolve, needs will change and so should UAS policies and strategies. Although it was further gathered that policymakers in certain countries in Africa only begin to engage with stakeholders at the project execution stage, Interviewee9 noted that engagement should begin right from the inception of policy formulation through to the project execution stage. In addition to this, policymakers should not organise consultation for the sake of it without actually considering and including such contribution in policy formulation as alluded to by Interviewee15 who stated that:

> *Although we* [MNO] *are allowed to contribute our views, but they seem not to be implemented.* Interviewee15

When the views of all stakeholder are considered and incorporated into the implementation process of USF, Interviewee9 argued that this will help to address the

issue of viability, sustainability and ownership of USF projects. Interviewee20 added that:

The point about a multi-stakeholder, regardless of the number, is that nobody should win. Often, people go into these processes thinking they must win… Actually, the outcome of any multi-stakeholder engagement should be a consensus…
Interviewee20

Interviewee20 further stated that stakeholders should not come into such discussion necessarily with the intention of winning but arriving at a consensus where the outcome is the most advantage or less disadvantage to all. Although managing different stakeholders who have different objectives is a difficult task for the regulator (Johnson, 2018), regulators and other policymakers have a critical role to play here in terms of coordinating the process and enforcing agreements.

Interviewees also highlighted that, more often than not, relevant stakeholders like local communities are excluded from the consultation process in some parts of Africa either by default or because of a lack of awareness. For example, although USF in Nigeria is structured to accommodate both bottom-up and top-down initiatives as indicated in Section 3.4.4, Interviewee9 revealed that local communities hardly come forward to demand coverage. Consequently, other stakeholders such as policymakers and MNO could shape events in their interest as noted in Section 3.2. This indicates that not all stakeholders are equally important in terms of their input and impact on policy direction, underlining the 'capture' form of regulation where 'small' but 'powerful' interest groups influence regulatory policy to work for them to the detriment of the public (see Section 3.2). Interviewee5 contended that the exclusion of local communities from the consultation process of policy decisions may prove detrimental to the expansion of mobile coverage as such people hold vital information on the actual state of affairs in disadvantaged areas.

Following the above analysis, it is apparent that there is a link between stakeholder engagement and the issues raised in Sections 5.3.1 to 5.3.5. Take SIM registration, for instance, the comments from interviewees suggested that various governments introduced this policy with little or no stakeholder debate about the wider implication for the industry, part of which is acting as a barrier to mobile adoption and usage. Furthermore, engagement with local communities could help to mitigate the issue of lack of needs assessments and forestall a mismatch between the demand and supply of telecommunication services. Overall, the responses from interviewees

suggest that if policymakers cultivate the culture of continuous stakeholder engagement, collective effort and pragmatic ideas may result, which could then help to limit the complexity of UAS. The next section further examines this and other issues relating to the complexity of UAS.

5.4 Universal access and service complexity

Although a UAS strategy like USF is consistent with the deployment of subsidy, it also has the attribute of a mandatory instrument since the payment of USF levies by MNO are compulsory (Sections 3.2.2). This makes USF a hybrid regulatory instrument, the implementation of which could be complex as it reflects the characteristics as well as the limitations of both mandatory and subsidy instruments discussed in Section 3.2.2. Similarly, the discussion presented thus far suggests that UAS encompasses diverse sets of interconnected issues, which makes policy formulation and implementation not only complex, but also dynamic. According to Interviewee24, it is where any of these issues are missing that UAS becomes problematic because:

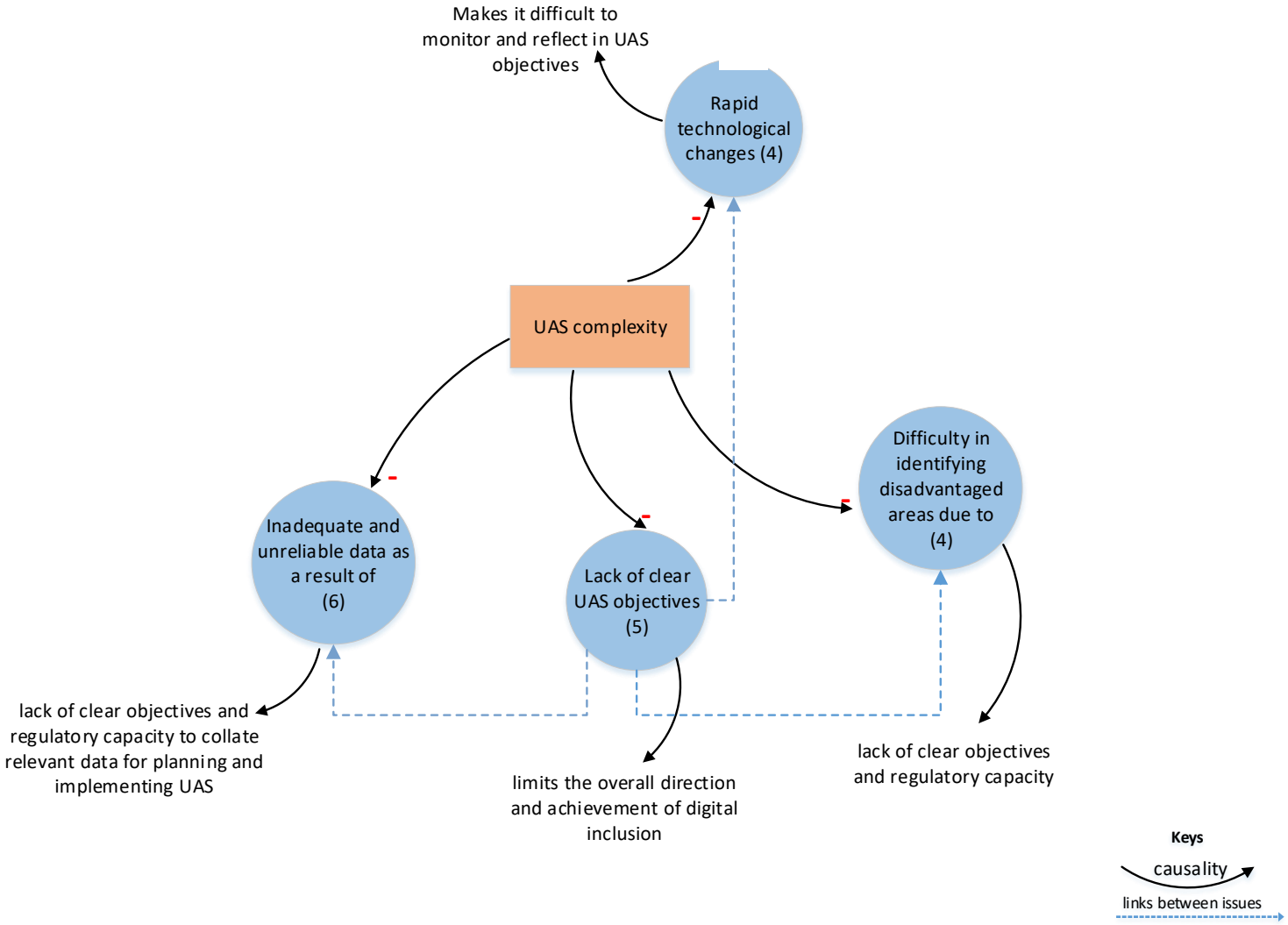
> *…one needs to execute all these elements together as a package, you cannot have one and not the other. When you have the problem of policy implementation in a country, then, it is most likely that one of these components…is often missing.* Interviewee24

Interviewee11 further echoed the complexity of UAS thus:

> *I have worked in this field for 17 years and I am talking with operators all the time, the USF is complicated and if there is a better way of reaching this last 5% we are all for it…* Interviewee11

It came across from the comments of interviewees that aside the issues raised in Sections 5.2 and 5.3, the typical starting point of the complexity and difficulty surrounding UAS in term of policy formulation and implementation is evident in a lack of clear UAS objectives, which then leads to other issues as highlighted in Figure 14. In all, Figure 14 highlights four key findings with respect to the complexity of UAS as examined below.

Figure 114: Universal access and service complexity



5.4.1 Lack of clear UAS objectives

Recounting their experiences across Africa, five interviewees revealed that one of the primary reasons why the implementation of USF appears to be complex and problematic is due to unclear UAS objectives. As such, it is not clear what policymakers are trying to achieve. According to Interviewee17:

> *There are a lot of reasons for that* [why USF are poorly implemented] *and the first is that in many cases, it is unclear what they are trying to achieve. In most cases, they charge or tax the operators in the industry and that is then administered by a regulator or by the government and reallocated to another operator in order to achieve some objectives, which are often unclear... I think it is a problem in parts of Africa - understanding the difference between need, availability, and affordability. I suspect that it is all three of those issues together that should be looked at and to some extent, they relate to each other as well…*

Interviewees further added that although UAS policies tend to focus on access from the viewpoint of availability in many countries, if no one actually connects to or adopts its services, it could be of no economic value. Consequently, interviewees contended that the development of clear and precise policies stems from having a clear definition for UAS, which then results in setting realistic targets for USF. This, they argued, is missing in many countries. Hence, a lack of clear objective, which then adds to the complexity of UAS and the setting of what appears to be unrealistic targets for USF. One of the implications of this in practice is that USF is seeing as a tool that can remedy all the information needs of the society, a feat that is rather difficult to achieve.

This is reflected in Chapter 3. For example, looking at the various definition of UAS in practice as highlighted in Table 4 in Section 3.3.1, they appear somewhat vague, that is, too broad in terms of services covered. For instance, the use of the word 'ICT' in many of the definitions, which in reality could mean a wide-range of services, technologies or networks. Furthermore, most definitions in Africa seem not account for all the underlying principles of UAS, which are the key success factors for achieving widespread access to telecommunications as explained in Section 3.3.1. According to interviewees, a robust UAS definition should encompass all underlying principles:

> *…it should not just be about coverage. If you solve the availability problem and you don't solve the affordability or the need problem, you don't really get anywhere. I think this is important when people think about the problem of universal service.* Interviewee17

This position is also supported by Interviewee19 who argued that providing access alone does not translate to usefulness. Interviewee19 added that this can result in low mobile adoption because people may be under the footprint of a tower with 3G or 4G capacity and end up not using it due to, for example, a lack of awareness.

The above discussion would suggest that there is a missing link between policy formulation, implementation and expected outcomes arising from what appears to be connected with the initial flaws inherent in the definition of UAS. This then results in a lack of clear objective, which does not only make the implementation of USF complex and problematic, but also makes it difficult for USF to target specific set of outcomes.

5.4.2 Inadequate and reliable data

Six interviewees, including Interviewee6, stressed that another reason why the implementation of USF has become so complex and problematic in many parts of Africa is due to the lack of adequate and reliable data to ascertain how many people actually lack access to a given telecommunication service. For example, Interviewees5 and 21 stated that:

> *One thing we don't have in every country, I am not sure of how far it goes yet, is reliable statistics of what mobile penetration is. I assume that you are familiar with the fact that what is called penetration, very often, is just number of active mobiles divided by either population or households. This does not tell us how many people or households don't actually have a mobile phone…* Interviewee5

> *The first thing I would say here is that there are no reliable good statistics to ascertain the true picture of mobile penetration. I'll be really interested in some quality data which look at what is the really rural penetration.* Inteviewee21

Apart from exacerbating the complexity of UAS, the lack of adequate and reliable data also becomes a barrier to the success of USF because the availability of such data is critical to the effective and efficient planning and allocation of scarce resources. A position that is further complicated by multiple SIM usage, which results in unreliable headline figures of mobile penetration that distort the measurement of digital divide in Africa as highlighted in Section 2.2. Without such reliable data, Interviewee20 asserted that policymakers might find themselves in a situation where they are giving subsidies to MNO for doing what is commercially viable:

…you don't want to be subsidising operators for doing things that are profitable to do. Bear in mind that what is profitable to them would change from year to year.

Interviewee20

A demonstrable example of this can be found in Lesotho where the regulator alluded to the fact that one of the challenges facing the implementation of USF in the country is a lack of reliable and accurate data to accurately identify disadvantaged areas with true access gaps (LCA, 2016). Consequently, they end up allocating USF to undeserving areas. This also helps to explain one of the criticisms highlighted in Section 3.2.2, which argues that the use of subsidies in addressing market failure encourages a dependency attitude on the part of market actors, which, in turn, delay market expansion and innovation. Aside from leading to the misallocation of funds, a lack of adequate and reliable data also make it difficult for policymakers to identify disadvantaged areas as discussed in the next section.

5.4.3 Identification of disadvantaged areas

Another issue that underlines the complexity of UAS is the identification of disadvantaged areas where the market would ordinarily not deploy telecommunication services to without some form of subsidy. According to one of the four interviewees that raised this issue:

Underserved areas are really tricky because how do you know if an area is underserved or not? Of course, it is easy to say where you have coverage of 90% and then you can simply assume that 10% are underserved. But if you have coverage of maybe 50%, then can you really assume that the other 50% is underserved? I really don't think so… It is not always correct to assume that all unserved or underserved areas are due to market failure. It may simply mean that the market needs to be created first. Interviewee24

The above response and that of other interviewees indicate that in practice when MNO fail to deploy services to certain areas, it is often assumed that such locations are being overlooked due to the lack of economic feasibility. However, the above interviewee suggested otherwise, arguing that it might be a case of missing market as highlighted in Section 3.2.1. Consequently, such area may be wrongfully classified as locations needing a subsidy, resulting in the misallocation of funds.

'Good' practice requires careful identification of disadvantaged areas prior to the allocation of USF in order to avoid and/or mitigate subsidy misallocation and direct scarce resources to vulnerable areas (Jamison, 2017). However, it goes without saying that to accurately identify 'true' disadvantaged areas, policymakers need to have

relevant data to guide informed decision and previous analysis in Sections 2.2 and 5.4.2 indicate that access to such data is largely lacking in across Africa. Furthermore, some level of human and financial resources are needed to map out areas that lack coverage, a feat that is lacking in parts of Africa (Section 5.2.1). This goes to show the dilemma facing regulators in their effort to implement USF. Having said that, there seems to be a link between reliable data and clear UAS objectives in the sense that if the latter is completely confused, it becomes difficult to know what kind of data to collect from the outset and regulators may find it even more difficult to identify the most deserving areas to allocate funds.

5.4.4 Rapid technological changes

The final issue to consider under this theme, as recounted by four interviewees, is the difficulty of policy in keeping up with rapid and constant technological changes. Interviewees argued that for UAS to be relevant, the underlying terms of reference, that is, regulatory framework, needs to evolve. However, the ability to do this and keep pace with technology appears to be a huge challenge for policymakers. For example, according to Interviewee8:

> *Another problem with USF is that technology development is so rapid that the regulators and USF struggle to keep up – this is understandable; we all struggle to keep up with technology development so it must be particularly challenging for those trying to regulate it…* Interviewee8

Interviewee20 alluded to this argument thus:

> *…the market is constantly shifting and so is the technology, it is, therefore, very difficult to run USF on the basis of a set of regulations or legislation because regulations and legislation go out of date so quick…* Interviewee20

According to the country analysis, the first USF project proposed in Kenya has an expected life cycle of seven months from project design to contract awards and execution (CA, 2015). Considering the pace of the evolution of technology and the argument of interviewees, a lot would have happened within this period with the implication that the usefulness of the project becomes obsolete or less relevant. The dilemma then lies in the relevance of such networks and services when completed because the telecommunication needs of the targeted communities may have changed over time. As a result, their needs may remain unsatisfied even when there is a network available. Consequently, what constitutes UAS is fast becoming a moving target because changes in technology would mean changes in telecommunication needs, a

dynamic highlighted in Section 3.3.4. This phenomenon further fuels the debate on what services should fall within the scope of UAS and if there a framework to cope with such changes?

Following the analysis presented thus far in this section, one could argue that what drives UAS regulation stems from its objectives. As such, for regulation to remain relevant and move with changes in technology, the definition and the objectives of UAS also needs to evolve. Therefore, changes in technology should trigger the need for a review of the initial objective, which would then influence the overall structure of UAS framework and USF targets. This goes to show that an underlining relationship exists between technological changes and the overall objectives of UAS as reflected in Figure 14.

5.5 Conclusion

The findings presented in this chapter clearly address **RQ1** by showing that the digital divide of uneven mobile coverage across Africa is due to a series of complex and interlinked issues as illustrated in Figures 12 to 14. These findings echo some of the issues responsible for digital divide and the difficulties encountered in implementing USF identified in Chapters 2 and 3. Chapter 5 thus validates some of the issues highlighted in the literature, for example, that digital divide can be explained by affordability issues, a lack of awareness and digital literacy (Section 2.4). More insights were also provided on some of the issues identified in Section 3.4.5 that limit the impact of USF in Africa. For example, while it was estimated that over $400 million was lying idle across 37 USF countries across Africa (ITU, 2013b; Thakur & Potter, 2018), Section 5.2.5 highlighted that the accumulation of idle funds is due to the lack of skills to quickly design projects and deploy funds as well as government bureaucracies that act to slow down the decision making process. Having said that, guided by the level of interconnectedness of issues and interviewees' responses, the overriding message from this chapter largely boils down two key underpinning issues of regulatory capacity and transaction costs.

From the above discussion, it is clear that regulatory capacity is critical to the success of UAS and digital inclusion in general in the sense that regulators need to be well-resourced to formulate, implement and police regulatory intervention. This is reflective of the issues raised in Section 5.2 where inadequate regulatory capacity

results in a ripple effect as shown in Figure 12. For example, a lack of skills to quickly design and implement USF projects leads to the accumulation of idle funds, which then subjects USF to corruption and fund diversion. The lack of skills and funds also impinges on the ability of regulators to effectively monitor and enforce USF and other UAS obligations with a wider implication on the poor performance of USF across Africa. Furthermore, when one considers the issues outlined in Section 5.4, it is apparent that without regulatory capacity UAS even becomes more complex as a great deal of human and financial resources are needed to, for example, design clear objectives, source the required data to effectively plan USF projects and identify disadvantaged areas to avoid misallocation of funds. Therefore, for a regulatory intervention like USF to effectively address the market failure of uneven mobile coverage, regulatory authorities need to be well-resourced otherwise very little can be achieved.

Issues around benefits and costs dominated the discussion in Section 5.3 and Figure 13 highlighted the various issues that feed into this discussion such as the costs of obtaining rights of way, frequency spectrum and taxation. Interviewees argued that these issues aggregate to increase the transaction costs of network deployment and maintenance. In an industry that is typically capital intensive like telecommunications, such pressure further adds to the burden of market actors like MNO who also need to finance the construction of supporting infrastructure like electricity, which is largely lacking across Africa. This was further highlighted by Thomas Chalumeau[102], who asserted that *"Energy is one of the main essential needs of our African customers. On the continent, there are 300 million people with no access to power"* (Chalumeau, 2018). When such costs are accumulated and compared to accruable benefits, which, in turn, is impacted by issues such affordability and low ICT adoption, MNO tend to concentrate attention and resources on commercially viable areas to the detriment of disadvantaged areas where over half of the population in Africa reside. The impact of transaction costs on the digital divide in Africa has also been acknowledged by the World Bank who has contributed over $10 billion to the continent since 1999/2000

[102] Thomas Chalumeau is the Senior Vice President for Strategy and Development, Orange Middle East and Africa.

with the aim of expanding coverage and reducing the costs of deploying telecommunications (World Bank, 2018b).

It is, therefore, clear from this chapter that regulatory capacity and transaction costs are the two most important issues that reflect on the overall data when it comes to closing the digital divide in Africa. This is further examined in Chapter 8.

Chapter 6: Findings – Improving coverage part I

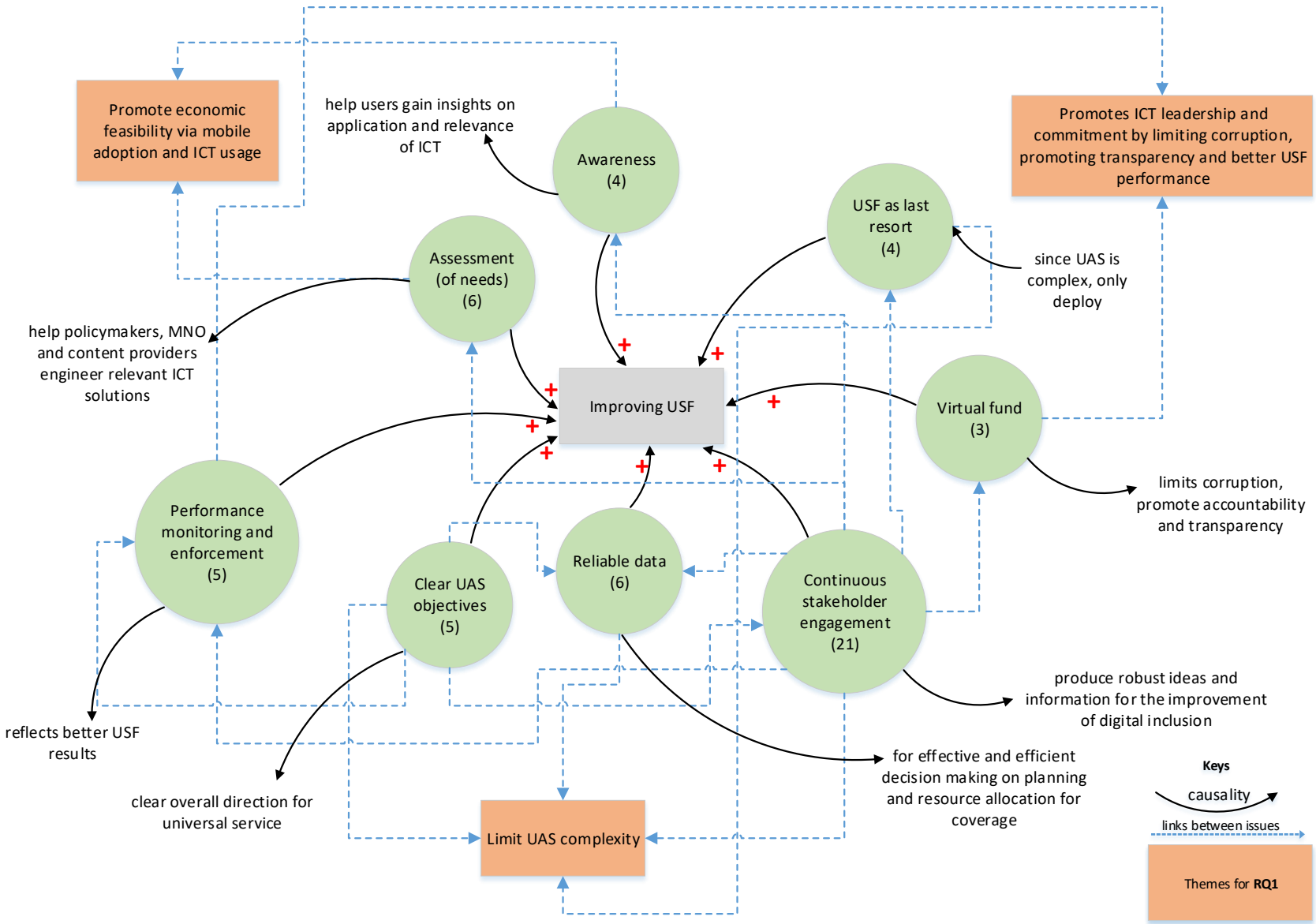
6.1 Introduction

As mentioned in Section 1.3, the presentation for RQ2 will be done in two chapters to make it easier for the reader to follow given the length of the findings from the data. Hence, this chapter and the next outline the findings from the data with respect to ***RQ2*** - *how can the digital divide of uneven mobile coverage be mitigated?* Following the same iterative framework and procedure outlined in Section 5.1, four themes emerged: improving the current form of USF, indirect market interventions, collaboration and innovative solutions for UAS. Since these themes unfolded as a result of the issues identified in RQ1, they will be examined in relation to the findings in Chapter 5 in a manner that shows how various issues intertwine and fit together. While this chapter examines the first two themes, Chapter 7 will present the last two themes, including a summary of both chapters, highlighting the key issues for further examination in Chapter 8.

6.2 Improving the current form of USF

In response to RQ1, there was a consensus among interviewees that the performance of USF across Africa is largely ineffective and, as such, disadvantaged areas that are supposed to benefit from the funds remain either unserved and/or underserved. While Chapter 5 has identified and extensively outlined the various issues responsible for the 'poor' performance of USF, this section presents the insights offered by interviewees on how to improve the current form of USF and develop an effective model that is capable of bridging the existing digital divides. The data map in Figure 15 presents a summary of these insights and how they address and relate to the corresponding issues that were raised in RQ1. A detailed report is presented in Sections 6.2.1 to 6.2.6.

Figure 15: Improving USF



6.2.1 Clear universal service objectives

Responding to the finding that USF is underachieving in most countries due to lack of clear UAS objectives (Section 5.4.1), five interviewees asserted that it is incumbent on policymakers to set clear and realisable objectives from the outset to provide clear overall direction for UAS and the USF that draws on its framework. To illustrate this, two interviewees commented that:

> *…there should be a governmental national prepared policy to improve connectivity within a country. For example, there should be a strategy paper… that declares the political commitment to achieve certain goals, and this paper should be…as succinct as possible… and it should be very, very clear and it should contain a list of policy actions…* Interviewee24[103]

> *...go back and ask yourself what do we want to deliver? Do we want rural coverage? Do we want, say as in New Zealand, to connect all the schools? Do you want to connect the hospitals and the medical clinics? Is that your objective? Then, what do you have to do to deliver that? I am giving these answers to draw contrasts to others that have done it differently…* Interviewee6[104]

Interviewee10[105] added that it is the responsibility of policymakers to design a framework where specific targets for UAS are succinctly defined and this should be properly documented and communicated when issuing/renewing GSM licences. When Interviewee6 was prodded on why USF should be deployed to connect places like schools and hospitals, they revealed that if MNO run fibre-optic connections to such places, they could then 'piggyback' on the same infrastructure to supply GSM connection to the same area. However, for any progress on coverage expansion to happen, interviewees argued that it is imperative for policymakers to be clear upfront on what they want to achieve in terms of what services should be covered, the types of institutions to be connected and the minimum population density living in a given square kilometre that USF should target.

Ten other interviewees, including Interviewee21[106] and Interviewee19[107], further argued that at the heart of setting clear UAS objectives is having a robust definition of *access*. By this, they mean a definition that not only considers coverage

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[103] An academic and UAS consultant

[104] An independent policy analyst and researcher

[105] A USF director

[106] A former multinational MNO figure responsible for public policy

[107] An independent research with interest in developing digital inclusion in developing economies

from the viewpoint of availability of the network, but also reflect affordability, accessibility, assessments and awareness as highlighted in Section 3.3.1. For example, Interviewee17[108] stated that:

> *A lot of universal services policies focus on access from the viewpoint of availability - on whether there is network or infrastructure but if no one actually connects to it or exploits it, it is of no economic value.* Interviewee17

While the relevance of affordability and accessibility to UAS has been highlighted in Section 3.3.1, these interviewees were particularly vocal on needs assessments and awareness creation. Interviewee24 argued that some amount of resources should be targeted at investigating what the 'real' information needs of a given community are in order to forestall a mismatch between the demand and supply of telecommunication services. When such needs are identified and provided, added Interviewee23[109], effort should be made to inform and enlighten people on the relevance of such services and promote digital education on how to use them in order to stimulate adoption and forestall redundancy. Interviewee19 added in the face of the rapid and constant evolution of technology, assessment and awareness should be considered as critical components for achieving UAS, otherwise it would be counterproductive to invest in coverage expansion that does not reflect the information needs of the society as people may end up not using the network and services provided. This support the argument to extend the three traditional principles of UAS to include assessment and awareness as argued in Section 3.3.1.

Drawing on the discussion above, Figure 15 indicates that there is an underlying relationship between assessment, clear UAS objective(s) and awareness in the sense that when the information needs of the society are known through an assessment, policymakers can then better articulate what to be included in UAS and the scale of resources required. This is evident in the following interview excerpt:

> *There is the need to spend a little bit of money to understand the true nature of the problem and depending on the answers to that, I will then set very, very clear objectives as to what problem I am trying to solve and put the money against that problem in a way that minimises the cost, maximise the opportunity for innovation...* Interviewee17

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[108] A former multinational MNO executive responsible for public policy, who is now an international policy adviser

[109] A former USF CEO who now consult for the ITU and some countries in Africa

While such a suggestion may be transformative to USF, its implementation in practice is currently limited in Africa as explained in Section 3.3.1. Nonetheless, the insights offered by interviewees have the potential to mitigate some of the problems identified in Chapter 5 as illustrated in Figure 15. For example, setting clear objectives can help to limit the complexity of UAS as USF can then target precise and realisable outcomes in contrast to the wide-ranging targets currently being observed across Africa (Section 3.3.1). Assessments and awareness could help to promote economic feasibility through the facilitation of mobile adoption and usage. This is consistent with ITU and UNESCO (2016: 81), which found that awareness creation can stimulate mobile adoption and increase market growth for MNO.

6.2.2 Reliable data

The lack of adequate and reliable data was highlighted in Section 5.4.2 as one of the causes of a lack of evidence-based policy to drive the implementation of USF in Africa. Six interviewees, including Interviewee18[110], suggested that when clear UAS objectives are set, this could then ease the collection of relevant data, which is critical for planning, resource allocation and implementation of USF. This is reflected in the comments of Interviewee5[111] and Interviewee21 thus:

> *One…recommendation…would be the need for better statistics and better monitoring so that we know what challenges we have to deal with. This is also important from the view of targeting any effort that goes beyond the market because at the moment, in many countries, we don't just know where the biggest needs are.* Interviewee5

> *The first thing I would say here is that there are no really reliable good statistics to ascertain the true picture of mobile penetration. I'll be really interested in some quality data which look at what is the real rural penetration.* Interviewee21

Interviewee11[112] added that the success of USF is partly hinged on having reliable data to actually measure who lacks 'what' and 'where' the most needs are even if it means having a rather approximate idea instead of allocating resources 'blindly'. Recounting a consultancy experience an African country, Interviewee11 stated that

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[110] A regulatory specialist with an international lending organisation who is working with countries in Eastern Africa to improve coverage in disadvantaged areas

[111] A well-established UAS consultant and research with over 20 years industry experience

[112] A USF specialist and UAS researcher with over 15 years' experience across 17 countries in Africa and the ITU

the first thing they did was to carry out a geographic information system (GIS)[113] mapping of existing network coverage for both 2G and 3G in order to ascertain how many people had access to services. They also obtained GIS reference coverage maps from all MNO in the country and hired a specialist who did an overlay of both maps for the country. This then allowed them to calculate the actual population coverage that showed that only 5.6% of the entire population was without any form of mobile signal, which in actual terms were over 2 million people. Following this process, they then began to plan the implementation of USF in conjunction with MNO and policymakers. Apart from helping to identify coverage gaps, Interviewee20[114] added that sourcing reliable data can also help policymakers to guide against subsidising MNO for doing things that are profitable, bearing in mind that what is profitable to them would change with time. While this process appears to be promising, one could also argue that the costs implication may restrict its wider application as regulators are generally faced with a lack of resources (5.2.1).

Apart from the GIS mapping strategy suggested by Interviewee11 above, Interviewee6 suggested a rather non-technical strategy, namely, a 'small-scale survey':

> *Ofcom in the UK has put a rather complicated mapping application where you could put in a postcode and it would tell you who has coverage in the area. I think there are still some disputes as to the accuracy of that. I mean that is technically quite difficult. Now, doing that in say DRC would be technically challenging. But the question could be what would small-scale surveys do?* Interviewee6

Going further, Interviewee6 suggested that small-scale survey could be conducted by opening a register at various local government councils and asking people to put down their names and locations against what telecommunication services they lack in their communities. This could be a standalone exercise or conducted alongside other events such as voters' registration and national census. Accumulating this over a period for different locations may then give an approximate idea of what the coverage gaps of a given community look like. Interviewee6 stated that it is incumbent on policymakers to take the responsibility to coordinate this exercise with organised interest groups including an enlightenment campaign to increase awareness across local communities.

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[113] GIS is a computer-enabled tool that identifies, capture, store and display information of geographical locations as well as various features in relation to the earth's surface.

[114] A former head of an intergovernmental ICT body, now an independent consultant and researcher

However, there is limited evidence to suggest that this would happen in practice considering that local communities are often excluded from policy debate as highlighted in Section 5.3.5.4. Another possible weakness in this strategy could also be the time lag between data collection, usage for planning and implementing USF, which may, in turn, slow down the overall process of coverage expansion or at the very least provide outdated information. Nonetheless, Figure 15 indicates that reliable data is imperative for a successful implementation of USF and helps to limit the complexity of UAS in terms of identifying coverage gaps and the locations impacted by market failure.

6.2.3 Continuous stakeholder engagement

As indicated in Figure 15, the comments from 21 interviewees help to underline the importance of a wider stakeholder engagement to the success of USF. This is evident in the following assertions:

> *I think in countries where USF have not been successful, the government should be willing to sit down with other stakeholders to evaluate the framework of USF, particular where the funds are there, after all, these monies are from operators and their subscribers and as such, it should be spent wisely*. Interviewee4[115]

> *…no single stakeholder can solve the problem alone. If the government just sets policy without consulting the industry, it won't work and the industry can't achieve anything without the support of the government. So they need to come together and listen to each other and consult with each other and then come up with some policies…* Interviewee11

In addition to this, Interviewee1[116] stated that stakeholder engagement should be a continuous process to reflect technological and service changes. Although stakeholder engagement at any level would require human and financial resources, doing this on a continuous basis as recommended by interviewees would arguably put more strain on regulatory capacity. Apart from the continuity of the process, Interviewee11 added that what it is even more pertinent is for policymakers is to define 'who' the relevant stakeholders are as this may also vary with the evolution of technology. The emergence of OTT players like Facebook (see Section 7.3.4) serves to illustrate this point. Overall, interviewees argued that policymakers should widen UAS conversation

[115]A former regulator who is now a regional head of access policy for a multinational OTT

[116] A civil society representative and access specialist promoting the proliferation of low-cost infrastructure in disadvantaged areas

to include representatives of, for example, infraco/towerco, telecommunication vendors (including handsets manufacturers), satellite providers, OTT, international lending organisations (like the World Bank), not-for-profit organisations (NGO), civil society and local communities.

Such argument is significant in the light of the findings that inadequate stakeholder engagement is problematic to the implementation of USF (Section 5.3.5.4). Interviewee23[117] and Interviewee1 revealed that even in countries where stakeholder consultation is conducted, it appears that such an exercise is skewed towards either governments, or, governments and MNO. Interviewee23 asserted that:

> *…a model which every stakeholder has a representation is bound to work better than a model that has only representatives from the government and politicians. Unfortunately, in most countries, the prevailing model is the later one, which is largely made of government.* Interviewee23

This further helps to highlight the issue of regulatory capture and raises the concern of how to balance different views against one another to reflect various interest groups as indicated in Section 3.2.3. While the interviewees did not specifically address this concern, they did state that each stakeholder group brings valuable input into the debate of UAS. For example, according to Interviewee13[118], MNO could fill the gaps of some of the expertise and skill sets needed to deploy USF, which may be lacking in the regulator and telecommunication vendors could come up with more affordable devices. NGO may look for ways to subsidise the cost of mobile devices for some communities, lending organisations can provide expertise from other countries with good examples, added Interviewee22[119] and Interviewee23. Additionally, Interviewee5 asserted that the local communities could provide local knowledge to help policymakers and service providers to better anticipate what is actually lacking in such communities. The whole process, moderated by policymakers, could result in collective tinkering that could ensure relevant opinions and experiences are considered to design a robust and dynamic UAS framework for USF and the overall process of digital inclusion.

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[117] A former USF CEO who now consult for the ITU and some countries in Africa

[118] A key multinational MNO figure with a footprint across Africa in charge of public policy

[119] A long-term academic and UAS expert

Five interviewees, including Interviewee5, drew attention to the fact that civil society and local community participation in ICT related issues are generally weak across the continent, as people from the grassroots are not engaged as much as they should even when the policies and debates are about them:

> *I think a bottom-up expression of demand and using civil society, are very valuable inputs, which has been sort of overlooked.* Interviewee5

Interviewee2[120] suggested that this problem could be mitigated by an increase in awareness and engaging the local communities by giving them some responsibilities in the formulation and implementation processes. For example, engaging with them to provide manual labour and land for the construction of infrastructure such as cables and towers. This is consistent with the analysis in Section 3.4.4 that shows that a bottom-up approach to the implementation of USF as practiced in Latin American countries like Brazil and Chile tend to yield better results than a top-down strategy.

Figure 15 indicates that the comments from interviewees appear to highlight a complex and dynamic relationship between stakeholder engagement and various issues raised in Chapter 5. For example, according to Interviewee21, local community engagement could help to provide free land or at a much more reduced price for the deployment of tower sites. As such, this could improve the economic feasibility in disadvantaged areas by helping to tackle the cost and difficulties associated with rights of way (Section 5.3.1). The skills, expertise and experience from a wide range of actors could also be harnessed to provide a synergy that is beyond the single effort of policymakers. On the one hand, this could help to address inadequate regulatory capacity (Section 5.2.1), and on the other help to limit the complexity around UAS (Section 5.4) by providing reliable information and encouraging cooperation from MNO and local communities.

6.2.4 Performance monitoring and enforcement

Reacting to the concern of a lack of performance monitoring and enforcement in Section 5.2.2, five interviewees, including Interviewee9[121], argued that it is not sufficient for regulators to award USF contracts, but they should also establish performance indicators from the outset. This is critical for tracking progress and

[120] A senior regulatory figure

[121] A head of spectrum administration

enforcing sanctions where MNO default. The comments from Interviewee22 and Interviewee23 underline this recommendation:

> *There is… the need to build in good planning and organisation into the policy formulation of USF… in terms of outcome, in terms of performance matrix.* Interviewee22

> *…If the operators are taking the money and doing nothing, USF can do very little but the regulator has a lot of power, hence, they should throw their weight behind USF so that in case some operators try to abuse USF, there should be some remedies available to ensure compliance.* Interviewee23

Interviewee23 added that if MNO say they have deployed USF projects in a given area, there should be a way to verify such claim because if what they have actually done is inconsistent with the terms of the project, this could undermine mobile coverage. Therefore, when projects are awarded, added Interviewee17, there should be a mechanism in place to check actual performance with what was agreed with MNO. Such mechanism should contain performance indicators such as project milestones, time to completion and the level of QoS. Interviewee10 insisted that such performance indicators should be clearly stated and communicated to MNO and in the case of default, there should be some remedies to hold MNO accountable. This is consistent with Section 3.2.2, which argued that performance monitoring and enforcement are part of the key success factors of deploying subsidies.

Talking about remedies, Interviewee24 articulated that one of the contributing factors to an effective monitoring mechanism is a robust legal framework:

> *…one needs a very strong, very well developed legal framework. The legal framework is there in order to implement this… commitment.* Interviewee24

In addition to this, there also has to be an active and a reliable legal system legal system that can confidently interpret a legal framework and enforce sanctions with due recourse to the law. Such sanctions may range from financial penalties to the loss of a licence depending on the nature and frequency of default (Hudson, 2006). It is also important to set the costs of such a default so high that it would discourage MNO from opting to pay the fines than actually executing the projects, as noted by Interviewee8[122]:

[122] The head of one specialised access provider deploying mobile networks in disadvantaged areas in the region

In some cases, operators would rather pay the regulatory fines for rural coverage non-compliance - a cheaper solution - than actually penetrating the rural areas… Interviewee8

It is, therefore, imperative that the consequence for non-compliance is set in a manner that discourages MNO from defaulting to ensure that the mechanism for performance monitoring and enforcement can reflect better outcomes for USF. Although UAS frameworks across Africa encompass various sanctions, evidence from Section 2.5 and Appendix A indicates that very few countries such as Ghana and Lesotho actually implement such sanctions.

Figure 15 suggests that there is a link between clear UAS objectives and performance monitoring and enforcement in the sense when policymakers clearly state what they want to achieve through USF, it becomes easier to devise a mechanism to match such objectives. Since this process involves a considerable level of interaction with MNO and the local communities, continuous stakeholder engagement could also prove useful.

6.2.5 Virtual fund

In order to mitigate the problems of idle fund (Section 5.2.5), corruption (Section 5.2.6) and fund diversion (Section 5.2.7), three interviewees, including Interviewee5, recommended making USF a 'virtual' fund. A virtual fund, according to Interviewee5, is some sort of accounting mechanism rather than an actual fund where MNO could be mandated to invest a given proportion of their revenue on mobile coverage in disadvantaged areas instead of actually paying USF levies. The following quotes serve to strengthen this recommendation:

…in order to rid it of some of the deficiencies associated with traditional funds, such funds may be set-up with features like being a virtual fund… Interviewee5

*One of what the operators say is that: okay, why don't we just propose our won projects? Instead of giving the fees to the government, we put the fees in a virtual account and then we propose our own project of how to reach non-commercial areas…*Interviewee11[123]

Interviewee4 added that policymakers should engage with MNO and ask them to use the amount that was supposed to be contributed via a USF levy to execute projects directly in a given disadvantaged location. The main thrust of the argument here is that

[123] A USF specialist and UAS researcher with over 15 years' experience across 17 countries in Africa and the ITU

the virtual fund may help to eradicate or mitigate the aforementioned impediments associated with traditional funds. For example, Interviewee5 contended that in a country where there is a political will to adopt this strategy, there may be no need for a central pool of idle money. Furthermore, nobody needs to guard themselves against accusations of malpractices, as there is no idle cash stored up anywhere even if such persons wanted to indulge in corruption. Since limited management is needed for such a fund, this could also help to mitigate inadequate regulatory capacity (Section 5.2.1). However, one could argue that this is debatable, as regulators would still need human and financial resources to ensure that MNO actually spend such money in disadvantaged areas. Interviewee4 also suggested that a virtual fund would yield better outcomes where stakeholders collectively decide areas of deployment:

> *This* [Virtual fund] *can be achieved by picking some target locations in conjunction with the operators annually and looking at what level of coverage can be achieved. Different proportions can then be allocated to different operators based on their resource capacities and level of investment and in so doing, create synergy among them.* Interviewee4

Projects allocation should then be implemented in phases in order to prevent MNO and other relevant stakeholders from being stretched beyond their capacities and commitment. This could also help policymakers to carry out their regulatory duties more effectively. For example, by concentrating scarce resources in policing a given area for a specific period before moving on to new projects. Regardless of the anticipated benefits, Interviewee11 had some reservations. For example, if one MNO say it spent a given amount on the rollout of coverage in disadvantaged areas and another MNO thinks it should be cheaper, how do policymakers coordinate and reconcile these two positions? This further underlines the importance of having an effective performance monitoring and enforcement mechanism to help prevent MNO from abusing the system and defaulting on their agreements. In conclusion, apart from mitigating issues like corruption, it could be inferred from Figure 15 that virtual fund could also help to improve accountability and transparency of USF (Section 5.2.9) as no physical money is collected over which there may be a financial impropriety.

6.2.6 USF as a last resort

The last point to be considered under this theme is the deployment of USF as a measure of last resort. This recommendation was advanced by four interviewees, particularly Interviewee24 and 17, who commented thus:

…my conviction…is that universal service as a policy should be used as an instrument of last resort - it should only be used where there is a so-called market failure, i.e., where the market does not supply either certain territories or certain people with telecoms services… Interviewee24

This does not mean that there is no role for USF but this should be seen as a last resort after everything else is exhausted, it shouldn't be the first thing to do. I am not a big fan of USF, there may be a case for them, but I think you should only do them when you run out of other ideas. Interviewee17

The underlying argument here is that since the operation of UAS is complex, policymakers should only employ this strategy after exploring all the possibilities that competition can offer. Interviewee24 asserted that countries should not be too quick to establish USF because the whole process requires a lot of capacity, which, to some extent, is lacking in some countries. For example, having an in/dependent regulator that has adequate personnel with the right skill sets, financial resources and the ability to coordinate and collaborate with a wider stakeholder. Executing these tasks together as a package is rather challenging and a country that wants to succeed with USF cannot have one and not the other, otherwise the difficulty of policy implementation becomes inevitable. As such, various aspects of competition should first be explored before considering USF.

Interviewee24 further stated that it is not always correct to assume that all disadvantaged areas are due to market failure, it may simply mean that the market needs to be created first and served by competition. Apart from creating awareness, interviewees also insisted that investment should be made in market research to ascertain if a given area is actually commercially viable or not and depending on the outcome of such research, the decision can then be made as to the suitability of competition and/or USF. The assumption of non-commercial viability was evident in the earlier stage of market liberalisation in Africa where multinational MNO were reluctant to enter the market at first with the assumption of insufficient demand (Ibrahim, 2012). The unprecedented level of mobile adoption now prevalent across the continent as shown in Chapter 2 proves that the initial assumption was inconsistent with market reality. A more recent example can be found in South Africa where Vodacom witnessed a pent-up demand of 1000% for data and 32% for voice traffic from 50,000 people after constructing 3G sites across 7 locations in rural Umhlabuyalingana municipality of KwaZulu-Natal (BusinessTech, 2018b; Tech Central, 2018). This followed a community-led appeal in April 2017 by the mayor of

the municipality for MNO to improve network coverage in the area, which is located along the Mozambique border with around 164,000 people (Tech Central, 2018). This also helps to support the argument that mobile penetration rates are largely overstated across Africa considering that the headline figure for South Africa is 159% as indicated in Figure 3 (Section 2.2), yet over 100,000 people remain disadvantaged in Umhlabuyalingana and this is just one of the six municipalities in the district of Umkhanyakude (Tech Central, 2018).

The above recommendation appears consistent with the Economides (2004) who states that regulatory intervention should only be employed as a 'last resort' where it is obvious that competition cannot completely address market inefficiency. Apart from reducing the strain on government budget and regulatory capacity, Figure 15 indicates that deploying USF as a last resort could also help to limit the complexity that comes with UAS.

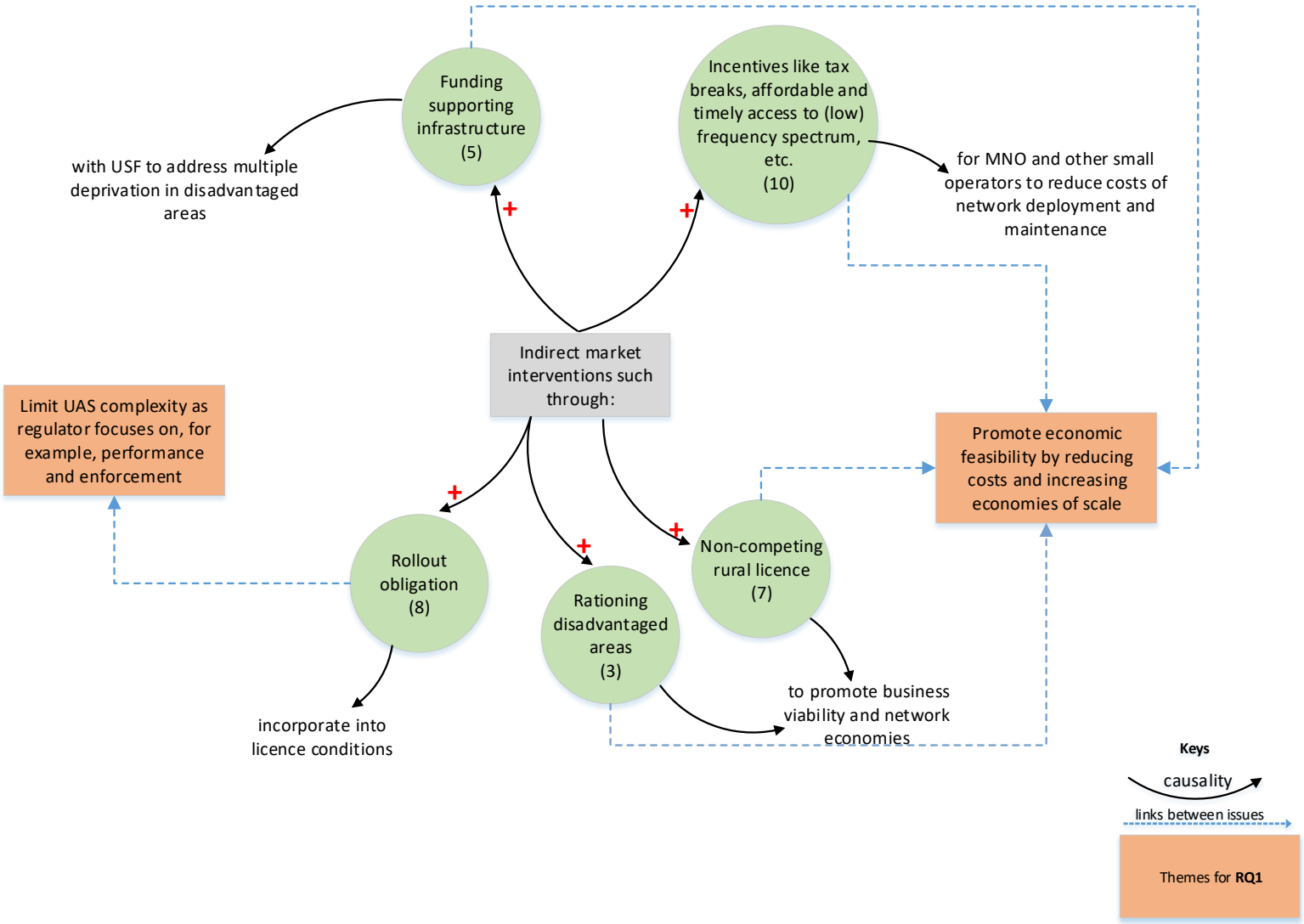
6.3 Indirect market interventions

Drawing on the preceding section, it is apparent that not all interviewees see USF as an effective means of achieving UAS to telecommunications. This thought was echoed by Interviewee5 who noted that:

> *Although not all people are in favour of USF but even those in favour would have to agree that there hasn't been an enormous success altogether*. Interviewee5

As such, certain interviewees, largely non-regulatory figures, suggested that policymakers should explore alternative measures to push coverage beyond big cities and towns. One of such alternatives is through indirect market interventions. They argued that not only would such measures help to limit the complexity that comes with UAS, but also help to lower transaction costs and, in turn, promote the economic feasibility of coverage expansion in disadvantaged areas with the aim of attracting small and large operators to participate in the process. The data map in Figure 16 presents the various recommendations made under this theme and the discussions are outlined in Sections 6.3.1 to 6.3.4.

Figure 16: Indirect market interventions



6.3.1 Rollout obligation

Firstly, ten interviewees suggested that USF could be replaced with rollout obligation where MNO would be required to commit to a predetermined level of investment in disadvantaged areas and execute such projects by themselves without the use of USF. Interestingly, two key regulatory figures were part of this group of interviewees. This recommendation came to the fore when interviewees were asked if there are other ways (aside USF) to ensure MNO do more to improve coverage in disadvantaged areas, to which Interviewee25[124] and Interviewee10 responded:

> *This can be done using coverage obligations in their license terms.* Interviewee25

> *The most important thing… has been the network rollout plan that you have agreed with operators when bidding for a licence. In Rwanda, when there's call for a new network operator to bid, one of the selection criteria is the network coverage plan.* Interviewee10

Interviewee22 added:

> *…I would recommend rollout obligation instead of having USF because MNO would then be held accountable for meeting coverage expansion into rural areas as part of their licence conditions. This is a better way to ensure rural coverage expansion than asking the operators to pay levies for USF.* Interviewee22

If policymakers decide to adopt this strategy, Interviewee22 continued, they would have to discontinue USF because they cannot have it both ways - MNO cannot be made to pay USF levies and at the same time mandated to rollout services in disadvantaged areas as this would mean double costs. However, Rwanda and South Africa appear to have rollout obligation and USF as part of their licence obligations. While rollout obligation in Rwanda has been successful relative to South Africa in terms of closing the divide in voice service with USF now being targeted at advanced services like data in rural areas, its implementation has been problematic in South Africa (Hodge, 2004, Lewis, 2013). Part of the problem in South Africa was that rollout obligation contracts were drawn without the flexibility of making changes as market conditions evolved, which is critical in a dynamic industry as telecommunications (Gillwald, 2005a; Hodge, 2004). There was also a lack of performance monitoring to ensure that MNO executed contracts as agreed, which resulted in limited outcomes (Hodge, 2004). Drawing on lessons from their home country, Interviewee10 asserted that sanctions for non-compliance need to be

[124] One UAS director

explicitly defined and enforced by the regulator in order to hold MNO accountable. Such sanctions could include licence revocation as a last resort after a given number of warnings and/or fines.

There appears to be a consensus regarding this strategy as this recommendation was not only supported by regulators and UAS experts but MNO interest groups as well. For example, Interviewee 3[125] commented:

> *…whenever new spectrum is being licensed especially low frequencies spectrum below 1GHz, which is good for rural coverage... the regulator can then impose coverage obligation to say that the winner of that spectrum would need to rollout infrastructure to cover rural areas…* Interviewee3

It was argued that rollout obligation could be implemented by combining economically attractive areas with unattractive areas as a condition for initial/subsequent renewal of GSM licences and/or spectrum allocation, especially low-frequency bands such as 700 and 800MHz that can propagate longer distance and wider signals. MNO would then be required to commit to coverage expansion in unattractive areas as part of the preconditions for getting such frequency bands. However, Interviewee18 cautioned that the success of operationalising this strategy is partly hinged on the willingness of policymakers to issue/renew GSM licence/spectrum free of charge or at a much more reduced rate. Interviewee18 drew parallels with countries like Sweden where they allocated 3G licence without asking for 'billions of dollars' during the auction. Instead, as part of the bidding process, the MNO that won the licence were required to cover rural areas for getting the licence free.

Following its implementation in 2005, Sweden achieved a 50% 3G population coverage at the end of 2005 and 99.6% in 2011 (EC, n.d.; GSMA, 2015b). Following another initiative ensued in March 2011, the auction of 790-862MHz from the 'digital dividend'[126] band, 4G population coverage increased rapidly across the country from 56% in 2011 to 90% at the end of 2012 (GSMA, 2015b). The increase in both 3G and 4G was driven by rural coverage expansion, which rose from 7% in 2011 to 70% at

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[125] A regional director for government and regulatory affairs of an international trade body representing the interest of MNO

[126] According to Doeven et al. (2012, p. 2), *"… digital dividend is used to express the spectrum efficiency gain due to the switchover from analogue to digital terrestrial television services."*

the end of 2012, illustrating the success of using low-frequency bands and rollout obligation in serving disadvantaged areas (Point Topic, 2017). In essence, it is not sufficient for policymakers to include rollout obligation into old or new licences, other dimensions need to be considered to make the offer attractive. Section 3.3.2 highlighted that this has also been replicated in Brazil, India and the Philippine with some level of success. For example, this resulted in coverage expansion for over 5,000 communities without recourse to USF in Brazil in 2007 as the winners of 3G licence in profitable areas like Sao Paulo in the south were obligated to deploy network to unprofitable areas in the north (GSMA, 2013b).

Lessons could also be drawn from Rwanda where Interviwee10 revealed that one of the criteria for issuing GSM licences in the country was that MNO were mandated to provide coverage plans that accounted for disadvantaged areas. It was gathered from Interviewee10 that this was how Rwanda managed to achieve a high level of population coverage, particularly for voice service within a 'short period' following the civil war. USF has now shifted focus to the deployment of advanced services like broadband. Figure 16 indicates that incorporating rollout obligation into licence conditions could limit the complexity of UAS as it helps the regulator to focus more performance monitoring and enforcement instead of a whole raft of complex issues associated with USF as discussed in Chapter 5.

6.3.2 Rationing and issuing non-competing licence

A second indirect strategy suggested by ten interviewees, including Interviewee12[127], is the rationing of disadvantaged areas among small and large operators, and then issuing them with a non-competing licence to be the sole provider for their allotted location(s). The following comments from Interviewee18 and Interviewee21 highlight this recommendation:

> *…we are not in a position to say that subsidy based mechanism is the best approach. Maybe it is time to look at other strategies being implemented in some countries. Take France and Scotland, for example, …they divided these unserved areas among the operators and the regulator mandated it…*Interviewee18

> *It becomes interesting* [covering disadvantaged areas] *in a situation where one operator does the deployment and if the revenue benefits were 12 and the costs were 11, then the operator can act more rashly and say 'well, if I go there, I will*

[127] A key figure of a specialised access provider

be the only operator getting all the 12 units of revenues for 11 units of costs, there's not much profit but I still have a little as a monopolist'. Interviewee21

This recommendation was borne out of the fact that one of the reasons why MNO cluster the cities and big towns is because of network economics – the costs of network deployment in relation to the actual benefit. The actual benefit is, in turn, dependent on factors such as, for example, population density and income levels. Section 5.3 highlighted that areas with sparse population density and low income would attract a low benefit in terms of ARPU. This could encourage digital divide to persist as the market may fail to serve such locations (Section 2.4). Hence, a considerable mass of people and income are critical to *"justify the relatively high costs"* of network deployment by MNO (Gillwald, 2005a, p. 13). Interviewees argued that if small and large operators were permitted to serve such disadvantage areas exclusively without competition and keep improving things over time, the business could be more sustainable even without direct interventions like USF. To further underpin this argument, Interviewee12 asserted that:

MNO would typically not cover disadvantaged areas not necessarily because there is no demand for telecommunication services, but for the fact that when multiple MNO compete in such areas it ultimately dilutes ARPU and makes it unprofitable. Interviewee12

Whereas, continued Interviewee12, if one operator had stayed there and improved things over time, then the business would probably become profitable and sustainable.

South Africa has attempted a similar strategy via its 'under-serviced area licencing initiative', which permit 'small-scale'[128] entrants to deploy network in disadvantaged areas albeit with financial assistance from USF (Gillwald, 2002). Although the initiative was proposed in 2002, delays resulting from infighting between ICASA and the Ministry of Communications over its implementation meant that licences[129] were not issued until 2004 (Gillwald, 2005a). Apart from delays, its implementation was also hampered by the lack of political will to release funding for the operators as stipulated in the licence conditions and licences appeared to have been

[128] Small operators with local ownership besides the traditional MNO in the country

[129] Four licences were issued in 2004 to Bokone Telecoms to cover Limpopo area, Thinta Thinta Telecoms and Kingdom Communications were both licenced to cover KwaZulu-Natal, and IIizwe Telecoms was licenced to cover Eastern Cape (Gillwald, 2005a).

awarded to operators that lacked the capacity to deliver projects (Gillwald, 2005a; Lewis, 2013).

To forestall these failures, interviewees recommended rationing disadvantaged areas and issuing non-competing licences without USF support. This is consistent with the argument for a natural monopoly explained in Section 3.2.1 with the implication that a limited number of operators may better serve a given location to allow for the maximisation of economies of scale and avoid inefficient duplication of resources. Interviewees argued that policymakers could then allocate areas based on MNO capacity, allow MNO to decide which disadvantaged locations they want to serve and/or offer such licence free to smaller operators to encourage their participation in the process. Interviewee4 particularly stated that in the light of competition, policymakers should guide against discrimination when allocating such licences. It was suggested that the whole process: from the identification of targets to allotment be done in conjunction with stakeholders including local communities and smaller operators and not unilateral (policymakers) or bilateral (policymakers and MNO). This would help to promote transparency in the marketplace and prevent the abuse of licence issuance as illustrated earlier in the case of South Africa. Interviewee24 asserted that it is incumbent on policymakers in different jurisdictions to consult with various stakeholders and decide what works best for them.

Interviewee8 and Interviewee5, however, cautioned that for this strategy to succeed policymakers need to mandate all operators in a given country to exclude Off-Net charges for such locations. For example:

> *...all the operators have to give national roaming to each other subscriber without charging anything extra. This was one mechanism where* [in rural France] *without duplicating the infrastructure, consumers got the benefit of competition because operator A was offering let's say x price to its own subscribers and the same price to other subscribers as well.* Interviewee18

The aim of this is to give national roaming to the subscribers living in such areas to promote affordability and help to sustain the business model of MNO that do not have a footprint in other disadvantaged areas due to rationing. Further, this would make it possible for smaller players to interconnect to the networks of the larger players at little or no cost, especially for serving sparsely populated areas. Section 3.2.1 argued that such price control strategy can help smaller players to mitigate the negative impact of network externality by overcoming limitations like small customer base and

restricted network reach. Figure 16 indicates that this strategy could to promote the economic feasibility of serving disadvantaged areas as economies of scale could help to absorb the impact of transaction costs.

6.3.3 Incentives

A cross-section of ten interviewees, including key regulatory employees, MNO, UAS experts and academics, suggested that policymakers can indirectly intervene in coverage expansion through the provision of incentives such tax breaks, affordable and timely access to (low) frequency spectrum and rights of way. The following interview snippets serve to underline this argument:

> *… I think the strategic intervention I would recommend is to lower the barrier to market entry. That entails a number of things. One is ensuring that there is an affordable access to the backbones… In most African countries, it cost more to deliver data to the coast than to get it from the coast to Europe or North America… So many countries treat telecommunications companies as a 'cash cow' in terms of generating revenue for the government. I think, at the very least, you want to reduce the taxes…*Interviewee1

> *Fiscal policy may also help in providing more incentives and compensation for operators willing to extend services to rural areas. This may include providing free land for the building of mast in such locations.* Interviewee2

The essence of such intervention is to boost economic feasibility in disadvantaged areas through a reduction in transaction costs for MNO and promote affordability for end-users. Section 5.3.3 illustrated that the tax burden on the industry is stark in certain jurisdictions in Africa either through 'high' tax rates and multiple levies. This, in turn, increases the overall transaction costs of network deployment for MNO and vendors who import, for example, equipment and mobile devices. A phenomenon which five interviewees, including Interviewee13, said impinges on the ability of operators to invest in coverage expansion and end-users affordability of mobile tariffs and devices like smartphones. In this light, interviewees argued that tax reduction and the elimination of multiple levies would reduce the costs of deploying infrastructure and service delivery and create an enabling environment that could incentivise MNO to invest in coverage expansion. In addition, vendors may be encouraged to lower, for instance, the costs of smartphones for the benefit of end-users. According to a key regulatory figure in Rwanda, this is one of the ways the government is driving the development of the sector:

…by removing 'all import taxes on ICT equipment' with the aim of reducing the costs of doing business and boosting the adoption and usage of ICT services. Interviewee10

Apart from lowering taxes and eliminating multiple levies, another way to incentivise MNO to participate in coverage expansion could be using the influence of policymakers to secure the required rights of way as earlier alluded to by Interviewee2. This was also echoed by Interviewee23:

This is a very big issue [rights of way], *particularly, in remote areas. The government should somehow help; USF could also help in getting the operators the required right of way, whether in the deployment of fibres or towers.* Interviewee23

Section 5.3.1 highlighted that obtaining rights of way in some parts of Africa could be very costly and problematic. As such, interviewees argued that in order to persuade MNO to expand coverage, policymakers might offer to secure such rights by negotiating with local communities and/or pay for the land to deploy infrastructure using USF. This is evident in the case of Nigeria where the Executive Vice-Chairman of the NCC used his influence to secure a 'permit fee' waiver of about $700,000 for MTN (Adepetun, 2017; ITNews Africa, 2017). This was to facilitate the right of passage for the deployment of fibre infrastructure in Kano, one of the northern states in Nigeria.

Furthermore, six interviewees, including Interviewee1, recommended that policymakers could also use spectrum as an incentive to attract both smaller and larger operators to invest more in disadvantaged areas. For example, Interviewee21 recommended that:

…indirect interventions in terms of promoting things like allocation of low-frequency bands can have a tremendous impact and a much more effective result. Interviewee21

This suggestion was offered to address the concern raised in Section 5.3.2 on the allocation and costs of spectrum. Interviewees suggested that policymakers should keep the price of spectrum low and not always see the sale of spectrum as an opportunity to raise more money for the treasury as such practice would greatly impact the costs of deployment and the final tariffs charged to end-users. Interviewee20 indicated that another way to reduce the costs element of spectrum is by using USF to fund the reallocation of different frequency bands. For example, when trying to release low-frequency spectrum for allocation to MNO, quite often, there are institutions like the military already using the spectrum that needs to be reassigned. USF could be used to help this process by offsetting some of the relocation costs.

Still on the issue of spectrum allocation, four interviewees, including Interviewee18, suggested that policymakers can go a step further by offering low-frequency spectrum such as those obtained from TV White Spaces[130] free to operators to connect disadvantaged areas in order to lower the cost burden of network expansion. According to Interviewee4:

> *Such move can also encourage small ISP players to deploy service to rural areas since the cost of doing so would have reduced with free access to spectrum. This will ensure the sustainability of such business model in rural locations.* Interviewee4

Interviewees17, 20 and 21, however, cautioned that when policymakers provide such incentives, they should also make sure that beneficiaries actually do what they have promised. For example:

> *When you provide such incentive, you have to also make sure the benefiting operator actually do what they have promised as a result of enjoying such subsidy. Since government control spectrum, they have power and control over the operators and if the operators know that their spectrum can be taken away and reassigned, this may force them to fulfil their obligations. Normally, not always, there are operators I know who have failed to meet their promises but on the whole, this is quite a good way of extending coverage*. Interviewee17

Interviewee17 further added that policymakers should then focus more on monitoring and enforcement and leave MNO to work out the most effective and efficient way to deploy networks in line with the incentives they have been offered. Interviwee20 then concluded that:

> *So you either create an economic incentive for the operators to serve unconnected areas or you create a disincentive for them not to*. Interviewee20

While Figure 16 indicates that the use of incentives may help to promote economic feasibility, the political will, which is both a necessary and sufficient factor, to adopt these recommendations may be lacking. This is because governments across Africa rely heavily on revenues from telecommunication taxes and licence fees to fund their national budgets (Curwen & Whalley, 2018).

[130] TV White Spaces are frequencies vacated as a result of broadcast TV migration from analogue to digital signals (Donner, 2015).

6.3.4 Funding supporting infrastructure

The lack of supporting national infrastructure such as electricity was highlighted in Section 5.3 by 13 interviewees as one of the major factors that exacerbate transaction costs and, in turn, limit the economic feasibility of network expansion. Consequently, five interviewees, including two former public policy executives of a multinational MNO, advocated that the idle money in USF could be used to fund the deployment of such infrastructure, especially, electricity, which appears to be a major challenge across Africa. The following comments serve to underline this argument:

> *...If you put USF in building a network and you then have no plan in connecting them to the electricity grid in say the next 30 years, you are wasting people's money. Go and spend it on the electricity grid, don't spend it on telecoms. Having grid power changes the economics of some of the so-called unviable areas.* Interviewee17

> *...something that looks at the deprivation of communities across many sectors might make more sense than a sector by sector one that has USF for telecoms and some other strategies for electricity and other utilities.* Interviewee20

The main thrust of this argument is that policymakers may continue to collect USF but instead of using it to directly deploy telecommunications in disadvantaged areas, such money should be used to deploy supporting infrastructure such as electricity and then allow MNO to do network expansion themselves. Interviewees argued that this would help to reduce the costs of network deployment and maintenance, for example, the high costs of purchasing generator sets, diesel and the provision of security to guard installations. Such costs savings would free up more money for investment and attract both small and large operators to extend their footprints into disadvantaged areas.

The criticality of electricity to coverage expansion cannot be discounted. This was alluded to by Interviewee14[131] in one of the countries that have over 100% mobile penetration rates in Africa. When the interviewee was asked how the country has managed to achieve such feat, it was revealed that the improvement of electricity played a key role:

> *...the complete electrification of all the country's populated locations... has, in turn, made it possible to spread the telecommunication network coverage to more than 99% of the kingdom's populated locations, thus providing a basic access to telecommunication services.* Interviewee14

[131] A key regulatory figure

This electrification was not done solely by USF but rather in a multi-sector approach via collaboration with the National Office of Electricity in Morocco through PERG[132]initiative. However, the feasibility of a multi-sector approach to USF, that is, funding other utilities like electricity alongside telecommunications, is rather difficult to evaluate, as evidence from the country analysis indicates that Mauritania is the only country in Africa to adopt this practice. APAUS[133] is responsible for promoting UAS to 'commercial public services' for 'low-income' population in Mauritania (World Bank, 2011; DGTIC, 2015). Such services include telephone, water and electricity. Although Mauritania adopted a multi-sector approach to address the deprivation of public utilities, its main challenge is the coordination between various departments and the harmonisation of interventions (World Bank, 2011). This has resulted in disjointed activities and the implementation of certain projects has stalled (World Bank, 2011). Although it may be difficult to judge the success of using USF in another sector from a single country example, the above analysis does illustrate the importance of complementary infrastructure such as electricity to coverage expansion. Furthermore, since disadvantaged areas appear to suffer from multiple deprivations like electricity, telecommunications and water, Interviewee17 asserted that:

> *They* [policymakers] *should not think of mobile telecoms separately from thinking about electrification and about power. Mobile telecoms policy should be enshrined in the overall development policy of a country, because without access to low-cost energy, not only can the operators not run the base stations, but also people cannot recharge their phones.* Interviewees17

Interviewee17 added that when telecommunication is provided and there is no electricity, this would most likely challenge the affordability component of UAS as tariff would increase to account for the extra costs of providing generator sets and diesel. This appears to underline the argument in Section 3.2.2 that the opportunity cost of subsidising telecommunications may be an alternative forgone in another critical sector like power. That being said, Figure 16 indicates that collaborating with other government departments in funding and providing supporting infrastructure such as electricity would help to lower transaction costs and improve the economic

[132] Programme d'Electrification Rurale Globale.

[133] Agency for the Promotion of Universal Access to Services - USF in Mauritania - was established by Ordinance No. 2001-06 of June 27, 2001 (DGTIC, 2015).

feasibility of network deployment. A detailed examination of other areas of collaboration is presented in the next chapter.

6.4 Conclusion

This chapter partially addresses RQ2 by presenting the various suggestions offered by interviewees on how to mitigate the digital divide of uneven mobile coverage in Africa. As indicated in Section 6.1, these suggestions unfolded because of the problems identified in Chapter 5. Hence, the discussion outlined in this chapter is intertwined with Chapter 5. Following the analysis in Chapters 2 and 3 where it was established that although market liberalisation and competition have transformed the telecommunications sector across Africa in terms of investment, infrastructure development and coverage, digital gaps persist in varying proportions. The effort of government in Africa to address the market failure of imbalance in mobile coverage led to the establishment of USF, which over 30 countries implement within the wider framework of UAS policy. However, due to challenges such as idle funds, corruption and lack of enforcement, the impact of USF has not been widely felt. Chapter 5 addressed these challenges in detail and at the heart of these issues were regulatory capacity and transaction costs.

To address these two key underpinning issues, Chapter 6 began with suggestions on how to improve USF in order to provide a model that is more effective in narrowing the digital divide. The findings in Section 6.2 highlighted that regulatory capacity is critical to the success of such model. For example, regulators need qualified staff with the relevant skill sets to succinctly articulate and design a comprehensive UAS framework to guide the implementation of USF. Apart from qualified staff, regulators also need financial resources to execute tasks like the sourcing of reliable data for planning USF, to carry out stakeholder engagement and conduct market research to ascertain who lacks ‘what’ and ‘where’. It then goes without saying that a regulator that is lacking capacity will arguably achieve very little in terms of promoting UAS.

The transaction costs of network deployment and maintenance is the second fundamental issue that resulted from Chapter 5, as MNO will typically base their decision to invest in network expansion on cost-benefit analysis. More often than not, areas where costs are perceived to outweigh returns will get little or no attention from

the market as MNO are keener on commercially viable locations. Although the deployment of telecommunications is generally considered capital intensive, Chapter 5 identified various reasons that tend to exacerbate the costs burden in Africa, which then limits the feasibility of providing services economically. In response to this, Sections 6.3 outlined series of suggestions, which policymakers and MNO could employ to lower transaction costs. For example, the allocations of disadvantaged areas among small and large operators and then issuing them with a non-competing licence to be the sole UAS provider for their allotted areas (Section 6.3.2). The argument here is that such a strategy would result in economies of scale and make the business of network operation more sustainable compared to competing networks from different operators. This is consistent with Section 3.2.1, which argued that certain disadvantaged areas would be better served with a natural monopoly of one or limited operators. Other costs reduction strategies are presented in Chapter 7, which is a continuation of the findings on RQ2 as indicated earlier in Section 6.1.

Chapter 7: Findings – Improving coverage part II

7.1 Introduction

Since this chapter is a continuation of the findings on RQ2, it follows the same approach laid-out in Chapter 6 to examine emerging issues as they related to Chapter 5 with more emphasis on how to lower transaction costs and improve economic efficiency of network deployment. This chapter begins by exploring areas for further collaboration as hinted in Section 6.3.4 and then move on to innovative solutions for UAS.

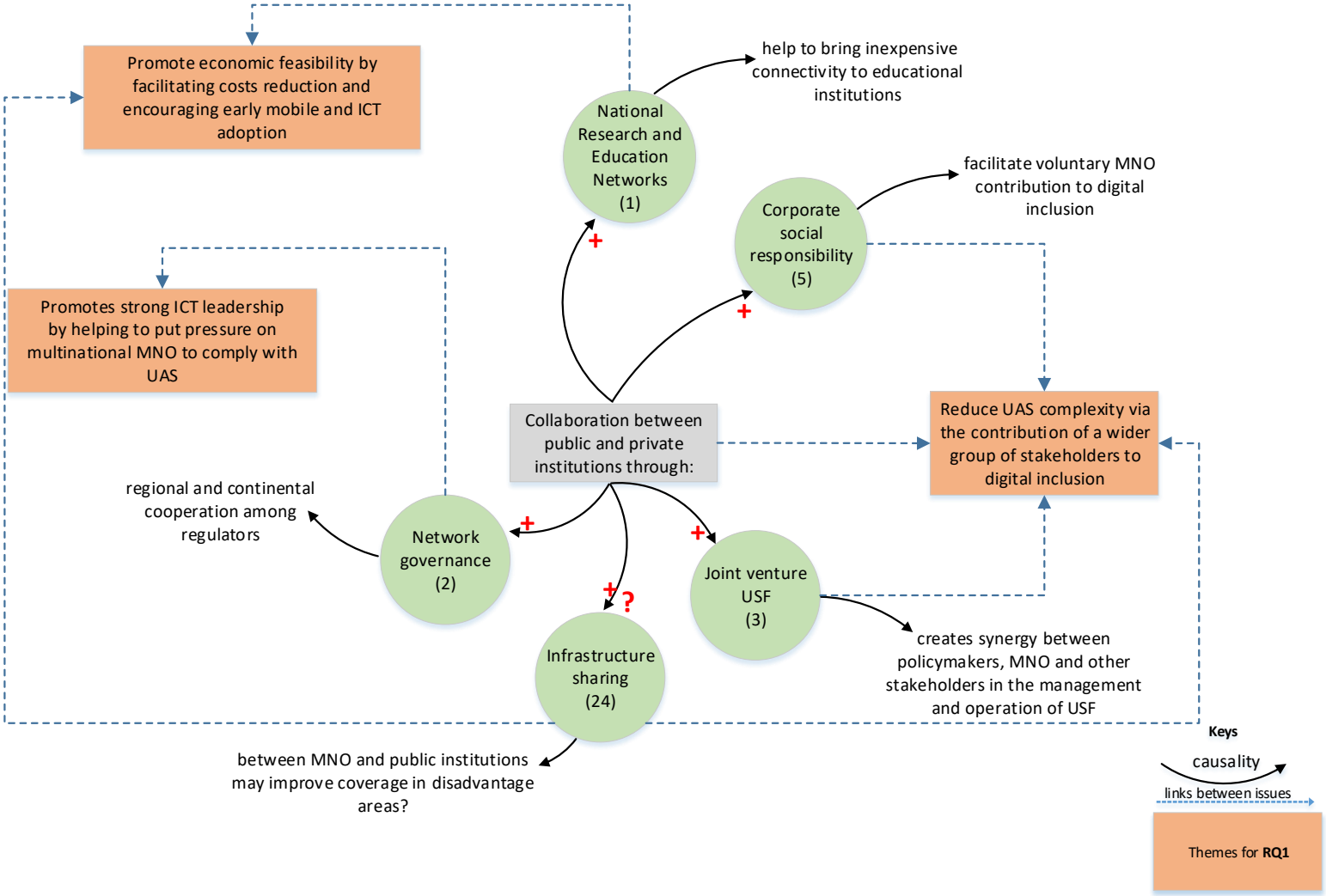
7.2 Collaboration

A diverse range of interviewees stressed the need for stakeholder collaboration in order to promote cooperation among various interest groups in building a more inclusive digital society. According to Interviewee13:

> *Now we still, as mobile operators, feel uncomfortable with the fact that our people are not as connected as possible and we are saying that perhaps the answer is in the cooperation…*Interviewee13

In many ways, the issues raised under this theme further underline the key role of continuous stakeholder engagement to the success of coverage expansion (Section 6.2.3). This is against the backdrop of interviewees suggesting that such collaboration should cut across wider interest groups. Figure 17 highlights the issues that emerged under this theme, which are subsequently discussed below.

Figure 17: Collaboration



7.2.1 Infrastructure sharing

Figure 17 indicates that one way through which stakeholders could collaborate to promote coverage expansion is through infrastructure sharing[134]. Twenty-four interviewees commented on this issue, albeit with mixed views. For example, Interviewee25 and Interviewee13 stated that:

> *Currently, operators in Egypt are using passive infrastructure sharing among them. This is done based on commercial agreements and not mandated by the operators. This is very beneficial to them, especially in remote areas. In projects financed by USF, operators are mandated to provide National Roaming to other operators in those areas.* Interviewee25

> *...there are different school of thoughts in terms of infrastructure sharing but definitely, it is the way to go as it will help us spend less and reach the most remote areas and fulfill that obligation from a rural coverage perspective.* Interviewee13

Aside from these two interviewees, three others, including Interviewee1, added that the benefit of infrastructure sharing to coverage expansion is *"incontestable"* as it is a demonstrable fact that if two or more MNO share the same tower, diesel generator and power backup equipment, their capital and operating expenditure (capex and opex) will be halved. This may then free up more capital to invest in coverage expansion because of the cost savings from sharing. While this may be true, one may also argue that if the process is not properly monitored, MNO may end up investing such money elsewhere as discussed in Section 3.2.2. Nonetheless, Interviewee8 added that evidence from countries where they have collaborated with MNO and towerco suggests that apart from acting as a cost reduction strategy, infrastructure sharing can also help to improve QoS for end-users as various specialists focus on their areas of strengths.

For example, towerco can provide specialised management of power-supply solution through the introduction of more efficient hybrid power solutions. MNO can then focus on building their brands as they compete on service delivery levels rather than infrastructure ownership. It was also suggested that infrastructure sharing helps

[134] It involves the partial or full sharing of telecommunications equipment and/or networks - where partial sharing is referred to as passive infrastructure, for example, tower, power supply, generators and security, and full sharing involves passive as well as active infrastructure such as spectrum, microwave radios, switches, antennas and backhaul (Baijal & Jain, 2007; Deloitte & APC, 2015; KPMG, 2011).

to lower the barrier to market entry, especially for new entrants and smaller players. This view was echoed by Interviewee10 who commented that:

> *We have also put in place infrastructure sharing guidelines on towers and sites to allow newcomers to use existing infrastructure...*

In spite of the benefits recounted above, three interviewees, including Interviewee1, argued that from their experiences across Africa, the practice of infrastructure sharing is often limited or at best restricted to passive infrastructure. When they were prodded on why this is the case, a couple of reasons emerged. First is a lack of trust. This is evident in the response of Interviewee1:

> *I think the reason it doesn't happen more often is because of a lack of trust... I recently came back from Liberia speaking with the three major MNO there and they have attempted several times to engage in infrastructure sharing... They have carried on for a few months but then the deal has fallen apart and it boils down to a lack of trust among MNO.*

Interviewee6 went further to add that MNO do not only have trust issues among themselves in terms of their competitors undermining their services, but there are also concerns that the regulatory and legal framework needed for effective implementation from policymakers may be lacking. This argument is consistent with Warsen et al (2018) who found that trust is a critical success factor when it comes to multilateral cooperation on infrastructural projects. Secondly, there is the fear that sharing core networks may reduce QoS because of shared capacity. This view was reflected in the comment of Interviewee9 thus:

> *The operators have mixed views about the introduction and acceptability of active infrastructure sharing due to competition issues and QoS concerns.*

Interviewee9 further asserted that the threat of a diminished QoS owing to infrastructure sharing might undermine ARPU, as coverage and service reliability appear to be among the critical factors that influence the choice of end-user. Thirdly, MNO, particularly the ones with first mover advantage, may not want to give up such competitive edge by sharing their network. Finally, this group of interviewees also raised the issue of On-and-Off Net tariffs. Typically, MNO who rollout first very often captures the market and keeps it through On-Net tariffs, i.e., offering low tariff to users within the same network and higher Off-Net tariff for users on rivals' network. Interviewee5 illustrated this with the case of Kenya where they found that even though Airtel offers a lower tariff, people working in Nairobi with families in the villages prefer a more expensive option offered by the market leader, Safaricom. This reason

being that Safaricom has a more extensive level of coverage compared to Airtel. Safaricom also offers cheaper tariff for On-Net calls than Off-Net and given that most of their families use this network, it is more economical to use Safaricom. Network externality, in this case, favours Safaricom.

Interviewee5 then concluded that MNO with low subscribers may not benefit much from infrastructure sharing because of the high margins between On-and-Off Net tariffs. This further underlines the argument in Section 3.2.1 that since network externality tends to favour the big players, its negative impact on smaller players may lead to market failure as (small) MNO may decide not to participate in such arrangement altogether.

In addition to the above, Interviewee20 and Interviewee24 reflected on other forms of sharing, namely, cross-sector sharing and single wholesale network[135]. The following interview snippets shed further light on this:

> **…***one needs to consider infrastructure sharing... between different mobile operators… but also infrastructure sharing between different sectors, for example, energy and telecoms…* Interviewee24

> *I think that makes sense* [infrastructure sharing] *… It is about how you structure it. A single network is going to be more cost-effective for telecoms in rural areas in the same way that a single railway network is cost-effective. Interviewee20*

Interviewee24 was particularly vocal on cross-sector infrastructure sharing arguing that the most expensive part of infrastructure deployment in practice is civil works, specifically, the digging and paving of roads for the laying of cables. Cross-sector sharing can help to reduce the costs associated with civil works through collaboration between respective sectors. Interviewee24 stated that it is incumbent on policymakers to facilitate this process by providing incentives for intragovernmental departments to collaborate in the deployment of infrastructure. For example, the ministry of works can collaborate with the ministry of telecommunications by inviting MNO to lay their cables during road construction. This will save costs of infrastructure deployment for all the parties involved and since such activity may require permission and/or rights of way, this could be negotiated and obtained jointly. It may also limit the level of

[135] This is also known as 'open access' in some jurisdiction. It is a situation where a country provides operators with wholesale access to network infrastructure and/or services such as backbones and broadband on a competitive basis that is fair, transparent and non-discriminatory (OECD, 2013).

activity disruption and environmental impact along such route. Furthermore, MNO could collaborate with railway companies to share any excess fibre capacity that may be available. Evidence of this exists in South Africa where Vodafone is collaborating with PRASA[136] in a deal worth over R1 billion[137] (Tredger, 2016). Vodafone would lease PRASA's 'dark fibre' cables - excess capacity - and make same available to public and private institutions at a reduced rate. However, the finite availability of rail infrastructure across the continent (ADB, 2015) may hinder the proliferation of such collaboration.

Moving to the issue of the single wholesale network, Interviewees20 and 17 argued that single wholesale is an 'extreme' form of network sharing where everybody resells and compete on the retail level. Interviewee17 recommended that single network should only be introduced when it is no longer possible to 'squeeze' coverage from competition. As such, stakeholders including operators and policymakers should then work together and come up with a proposal on how this should work. Although there is a growing support for a government-controlled model of single wholesale network in Zimbabwe (see Section 8.3.2), Interviewee17 argued that evidence from practice suggests that this is not the right way to go. Mexico is a classic example where the government has budgeted $7 billion to set up a single network to compete with Telmex, which controls about 80% of the mobile market (Frontier Economics, 2014; TeleGeography, 2015a; Webber, 2016). Despite the large amount that has gone into the project, Interviewee17 stated that it appears that there is no end in sight, putting the success of the entire project in doubt. Similar outcomes can be observed in the cases of Nigeria and South Africa where single wholesale network has been proposed for mobile broadband delivery to prevent competing mobile networks from leaving disadvantaged areas behind, its implementation has proven to be problematic (Frontier Economics, 2014; Gilwald, Esselaar, & Rademan, 2016).

Take the case of South Africa, for example, it is argue that one of the reasons why the so-called WOAN[138] has failed is that such initiative needs strong institutional capacity and skills for a successful implementation, both of which is lacking not only

[136] Passenger Rail Agency of South Africa

[137] An equivalent of about $74.3 million

[138] Wireless Open Access Network

in South Africa but other parts of the continent (Gilwald, Esselaar, & Rademan, 2016; Gillwald et al., 2017). Furthermore, there is the issue of a lack of clear policy action to guide the implementation of WOAN coupled with the lingering challenge of spectrum allocation (Gilbert, 2016b). There are also concerns that the current proposal of WOAN could create a monopoly in the market (Mzekandaba, 2017c). In the light of these difficulties, Interviewee17 concluded that:

> *…it is a very risky strategy for government to get involved in the telecommunications market directly and history does not suggest this is a good idea looking at the poor state of the industry pre-liberalisation.*

Interviewees17, 20 and 24 proposed a joint venture model that is regulated by government but managed by the private sector who are better skilled and equipped to execute the project. In order to prevent rent-seeking MNO from exploiting the situation and treating others unfairly, Interviewee17 highlighted the need for regulatory oversight. Such regulatory oversight should also ensure that networks are upgraded as at when required, added Interviewee20.

In contrast to those that supported infrastructure sharing, four interviewees, particularly Interviewee12 and Interviewee21 had some reservations. They commented:

> *I actually don't think infrastructure sharing has a big part to play here because of the way in which rural villages work. Interviewee12*

> *Network and infrastructure sharing can stop stupidity – the ridiculous duplication of infrastructure - but it just can't change the fundamental economics because if you half the costs, you half the revenues, it is still the same equation. Interviewee21*

This group of interviewees agreed that sharing in general could lower costs so that it becomes feasible to provide services economically, however, it does not change prevailing circumstances such as sparse population density, low ICT usage and low-income levels in disadvantaged areas. Hence, there may not be enough customers to compete for or their ability to afford telecommunication services might be restricted by their disposable income. They further argued that sharing might not necessarily work for disadvantaged areas because whoever is first to deploy to a given village, for example, tend to get most of the customers. In this case, MNO might not be interested in going into such location even when there is an opportunity to share infrastructure. Therefore, while Figure 17 shows that there was a consensus among interviewees, that infrastructure sharing reduces the overall costs of network deployment and

maintenance, opinions were split on whether it could facilitate coverage in disadvantaged areas. Consequently, Interviewee5 stated that:

> *I don't think, as far as I know, that anybody has worked out exactly where you should draw the line or indeed whether it is a sharp line or some sort of gradation in the middle. This is something we should face up to and that could be a whole Ph.D. in itself if you went into it in enough depth…* Interviewee5

Interviewee13 added that:

> *This* [infrastructure sharing] *needs to be further explored because it has different level of complexities.* Interviewee13

Both interviewees suggested that there is a need for further research in order to have a more informed understanding of the 'where', 'what', and 'how' of infrastructure sharing. That is, 'where' is the right location to share in terms of rural, urban, both or in-between, 'what' part of the sharing should be promoted in terms of active and/or passive infrastructure, and 'how' should the sharing be done with respect to process, procedures and regulations.

7.2.2 Joint venture USF

Another form of collaboration suggested by three interviewees[139] is the operation of USF as a joint venture, that is, formulating coverage policies, managing and operating USF in partnership with other stakeholders. The following excerpts from Interviewee13 and Interviewee15[140] help to cement this argument:

> *Maybe the fund needs to be managed by a joint venture… with enough scrutiny in terms of managing the investment… strong internal policies that any commercial business has. From this perspective, not only would the fund benefit from the expertise of the operators but also from their way of doing business, which… is more effective and efficient.* Interviewee13

> *It* [USF] *should be taken away from the government and managed by an independent party that can allocate it for services it is meant for under the management of a committee representing all… shareholders that contribute to the fund and it needs to be audited both in terms of the collections and the services it is deployed for… like what was done with the number porting company in South Africa where all the carriers are shareholders.* Interviewee15

The two interviewees quoted above argued that a joint venture approach would create a synergy where all relevant stakeholders can make vital and creative contributions so

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[139] Two key MNO figures representing pan and multinational entities and one civil society advocate.

[140] A senior representative of one pan-Africa MNO

that USF can benefit from a rather more diverse opinion on how to achieve an all-inclusive digital society. Interviewee15 further suggested that a USF that is jointly managed and operated by a broad interest group would not only strengthen its independence but also promote a more transparent process where parties have their respective responsibilities. Interviewees1, 5 and 23 also suggested that civil society and local communities should be involved in the process, as the local information they provide can prove useful, especially when it comes to ascertaining what kind of infrastructure and services are needed in a given location. Interviewee1 suggested that one way of doing this might be through shared responsibilities in terms of resources and commitment:

> *I would ensure that it is essential for municipalities to co-invest in the network so that they have some skin in the game*. Interviewee1

Such effort, added Interviewee1, would ensure that all relevant stakeholders have some form of stake in coverage expansion and pooling their collective resources. This could then help to mitigate the misallocation of risk largely inherent in the current USF model in Africa where bureaucrats have nothing to lose in the event of failure. When all relevant stakeholders have a 'skin' in the game and vested interested in the process, there would be more incentive to be ambitious and more success could result. For example, civil society and local communities could put more pressure on policymakers to deliver, especially where project execution is delayed or abandoned, MNO would not sit back and watch the levies they have contributed being misallocated or diverted, and policymakers would want to deliver to their people to gain more approval.

However, this recommendation does not address the coordination issues like communication and the harmonisation of diverse interests from stakeholders raised in Section 6.3.4. Furthermore, giving that the participation of civil society and local community in ICT debate is generally limited in Africa (Section 6.2.3), it may be difficult to involve them in the process, not to mention the resources needed for repeated contacts and organising consultation meetings. Nonetheless, Figure 17 indicates that joint venture USF has the tendency to reduce the complexity of UAS by drawing from diverse expertise and knowledge of stakeholders. It can also promote strong ICT leadership and commitment as policymakers and other parties have the incentive to make USF work due to their vested interests.

7.2.3 Network governance

Responding to the lack of performance monitoring and enforcement of USF and other coverage obligation raised in Section 5.2.2, Interviewee12 argued that this problem partly stems from the lack of strength of regulators in terms of their ability and resources vis-à-vis large MNO. The following extract helps to underline the impact of large MNE on small countries:

> *Nigeria is a big country… they can stand up to MTN so the government has some amount of leverage. However, when MTN go to say Zambia, invest a couple of millions of dollars, buildout the networks, employ some 2000-3000 people, etc. and then the government decides that: MTN you haven't done your rural coverage, therefore, we are going to fine you say $50M. MTN just goes 'oh okay go ahead… and see what happens'. This is because, essentially, MTN are bigger, stronger, and wealthier than Zambia. Furthermore, when Zambia says okay MTN get-out, all of a sudden, you have up to 3000 people unemployed and these people may be supporting another 4-5 people. So the relative weight of these mobile operators in Africa is generally bigger than a lot of the states…* Interviewee12

In other words, some MNO are global MNE with a vast amount of resources and influence and considering that the regulators in Africa are (generally) often under-resourced as evident in Section 5.2.1, they are comparatively weaker. Section 2.3 highlighted that the spread of FDI is a key driver of the transformation of telecommunications market in Africa and MNE are critical to attracting such investment. While they have attracted over $70 billion for the deployment of telecommunications infrastructure in Africa from the late 1990s/ early 2000s, a further projection of $214 billion has been estimated by 2020 (GSMA, 2016a; van-Huyssteen, 2012). MNE MNO are thus powerful and with their resources, they can exert a great deal of influence over the regulators. Interviewees argue that this can undermine the ability of regulators to enforce obligations and hold MNO accountable. Interviewees6 and 20 suggested that one way of dealing with this problem is through network governance:

> *…the regulators are very weak in relation to the operators. There is, therefore, the question of how do you solve that problem? …regional collaboration among countries could be part of the solution.* Interviewee20

> *…if you were to look in Europe, or the OECD countries, the key places where the discussions on universal service take place are within the European Commission and its Committees, or within the OECD Committees. Now, that kind of network governance doesn't really happen in Africa. So, there is an institutional issue there which says if African countries really want to optimise their rural coverage and universal service, there ought to be a kind of network governance, whether at the*

level of ECOWAS or AU, to sit down and brainstorm on what works and does not work. Interviewee6

Interviewee6 asserted that network governance provides regional policymakers with the opportunity to congregate for the purpose of cooperation and collective action to tackle the market power of large MNE. The decision taken in such platform will then assist policymakers at national levels to hold MNO accountable because MNO may be richer than some countries but not in their sum of parts. Although some of these organisations exist across Africa[141], there is very limited evidence (as illustrated with the case of COMESA[142] below) to suggest that they collaborate to pass binding harmonised regulations that could put pressure on MNE to comply with the proliferation of UAS. However, this is evident in the EU where countries have localised laws from the Digital Single Market directives, which is binding on MNO across member states. For example, Directive 2014/61/CE – measures to reduce the high cost of deploying high-speed broadband (EC, 2016). In this case, small member states, in terms of size and resources, can arguably deal with MNE from a position of 'strength'.

Regulatory cooperation can thus give regulators a bit more clout to put pressure on MNE to comply with issues related to UAS. Figure 17 illustrates that this could help to promote strong ICT leadership and commitment through the enforcement of coverage obligation. For example, in October 2017, COMESA reached an agreement to collectively eliminate roaming charges for mobile users across member states in an effort to reduce mobile tariff and address affordability problem (Malakata, 2017a). Upon implementation, MNO in these countries will need to comply as this is a collective agreement of 18 countries across Eastern and Southern Africa.

[141] For example, The West Africa Telecommunications Regulators Assembly and Southern African Development Community (ITU, 2011).

[142] Common Market for Eastern and Southern Africa is an economic bloc of 18 African countries, including Egypt and Seychelles

7.2.4 National Research and Education Networks (NREN)

The last form of collaboration suggested by Interviewee5 is that policymakers should consider collaborating with National Research and Education Networks (NREN)[143] as this could help to bring inexpensive connectivity to educational institutions:

> *Another point I should add is how worthwhile it can be for universal service managers to collaborate with national research and education networks (NREN)… There is often international support for NREN (e.g. from the European Union), which significantly brings down the cost of international connectivity …this can be a valuable part of government universal broadband strategies.*
> Interviewee5

The underlying argument for the connection of educational institutions is that it acts as a catalyst to increase ICT demand and the adoption of mobile telephony because as Interviewee17 noted:

> *…when you think about universal service, demand aggregation for say children are called schools.*

In the same light, Interviewee24 added:

> *When I also think of broadband the biggest investment you can make is in schools… I think money is better spent in connecting the schools either with a computer lab or tablets… I mean if you think about where such monies are best invested; it should be on the future of the country like what we just did in Botswana where mobile operators agreed that it is good to connect all the schools to broadband.*

This interviewee was drawing parallels from what they did in a consultancy project in Botswana. It was revealed they managed to convince MNO and policymakers that it is critical to connect all the schools in the country to broadband, as this is a better way to accelerate digital inclusion since young people are more likely to continue to access telecommunication services through their mobile devices even while at home. It, therefore, creates an indirect demand and promotes the early exposure of young people, who will form the bulk of MNO future customers, to the benefit of the internet. When this happens, MNO may then be encouraged to further deploy infrastructure and services as a result of perceived demand.

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[143] NREN are NGO made up of academics and scientific communities that champion the provision of internet connectivity to educational institutions through coordination and collaboration with local and international bodies (Dyer, 2009; Metri, 2018a). For example, GEANT in Europe, Internet 2 in the USA and RedCLARA in Latin America (Metri, 2018a).

Since educational institutions connectivity is a viable means of promoting ICT usage and adoption, Interviewee5 recommended that collaboration with NREN could help to facilitate the spread of affordable connectivity to such places and ICT diffusion. Interviewee5 suggested that MNO could also be encouraged to include some level of school connectivity in disadvantaged areas as part of their corporate social responsibility (CSR)[144]. Tanzania is one country where such an initiative occurs. For example, the e-School Project of Tigo Tanzania has collaborated with the Ministry of Communication to deploy computer labs and internet access points across secondary schools in Tanzania (ITNews Africa, 2016a; Touchard, 2016). The ministry was responsible for identifying the schools while Tigo was responsible for funding the project. Figure 17 indicates that collaboration with NREN and MNO via CSR can help to improve the economic feasibility of network expansion as school connectivity will promote early exposure of young people to the benefit of using ICT. This will, in turn, spur an increase in mobile adoption and usage.

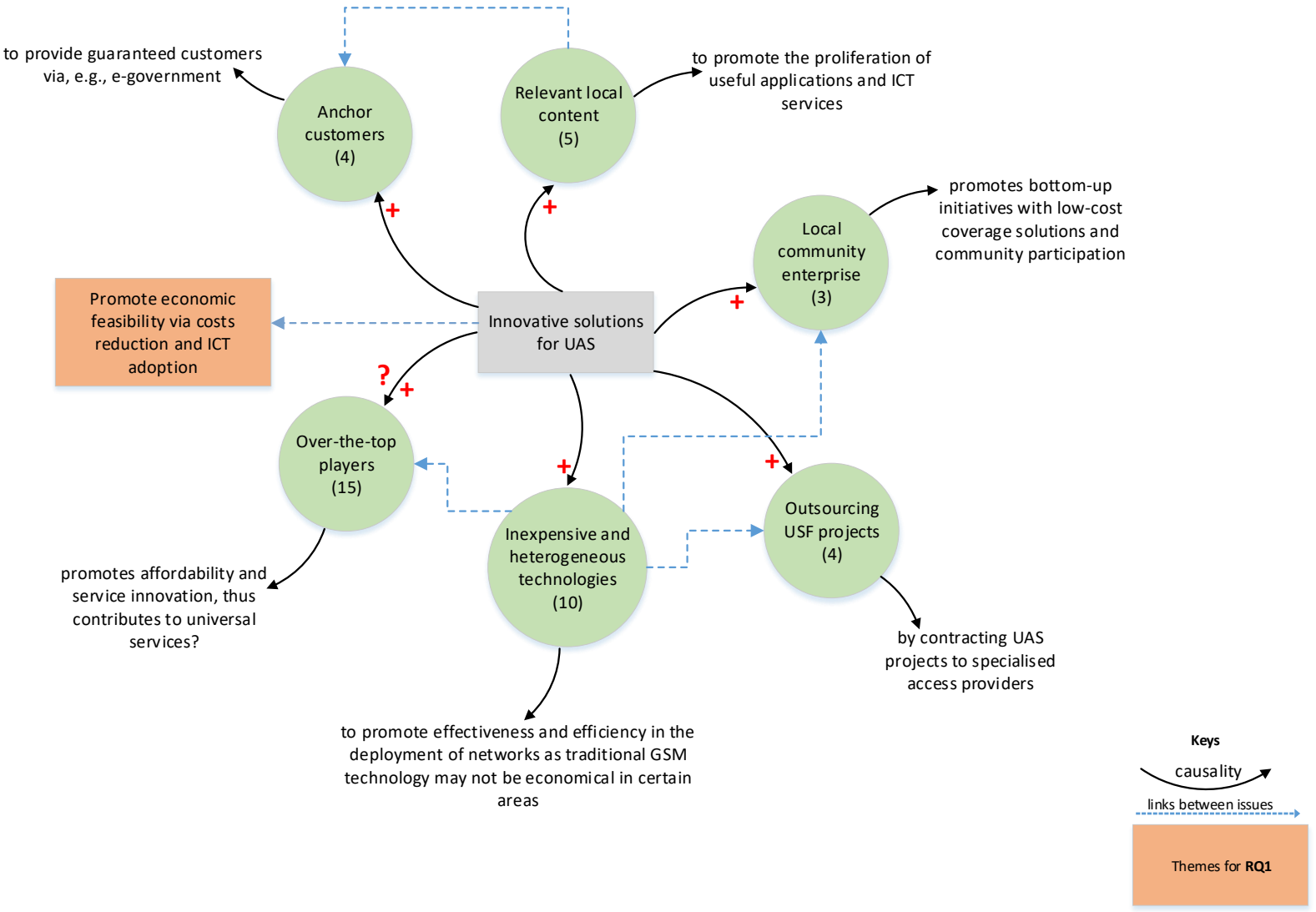
There are over 18 NRENs operating across Africa, for example, UbuntuNet Alliance in Eastern and Southern Africa, with funding support from the EU through the AfricaConnect project with a mixed picture in terms of their impact (Foley, 2016). The main challenge is the difficulty of getting government leadership to buy into the initiative, which has resulted in a lack of funding and expansion (Foley, 2016). Since this lack of persuasion by government leadership is partly due to the lack of awareness on the workings of the Internet, the value added that NREN can bring to higher education and digital inclusion in general, there is a need for more advocacy to bring policymakers on-board (Foley, 2016).

7.3 Innovative solutions for universal access and service

In the light of the issues raised in Section 5.3, interviewees suggested that disadvantaged areas could become more attractive if policymakers would allow and encourage various innovative solutions for UAS to flourish. The various issues that emerged from this theme are presented in Figure 18 and discussed below.

[144] Corporate social responsibility are various forms of voluntary and social welfare activities, which goes beyond profit maximisation of firms with the aim of making them socially responsible and global corporate citizens (McWilliams, 2015; Sutherland, 2016)

Figure 18: Innovative solutions for universal service



7.3.1 Inexpensive and heterogeneous technologies

Seven interviewees argued that policymakers and MNO need to be pragmatic about their technological choices as the sole deployment of traditional GSM network may not be cost-effective in certain disadvantaged areas. This recommendation is reflected in the following quotes:

Another important thing is to try and consider different technologies… because very often when people talk about mobile, they seem to talk about circular technology, but if we speak of mobile in a broad sense, we can see that, for example, satellite is mobile in a way, or Wi-Fi, or WiMAX, or other technologies. One should think about this mix of technologies in order to bring mobile connection or the internet to everybody as this would bring true connectivity to countries… Interviewee24

I think generally, we on the technology side should have a rethink especially about the deployment of the same technology to all areas like 4G and 5G. These technologies are very expensive to deploy especially in rural areas where it does not make economic sense to do so as they may not be profitable... So there should be some effort to have other cheap technologies that can provide services to rural areas… Interviewee4

These views were supported by Interviewee1 who added that since the costs of deploying coverage to disadvantaged areas using traditional solutions have proven to be significant, policymakers should encourage and facilitate coverage expansion using a combination of technologies. For example, Wireless Fidelity (Wi-Fi) provides the possibility of deploying inexpensive wireless local areas networks with the capacity of covering an entire village, depending on the size. This is more cost and time effective compared to GSM technologies such 3G (Graham, 2016). World Wide Interoperability for Microwave Access (WiMAX) technology could be used to connect various Wi-Fi hotspots and Wireless Local Area Network (WLAN) to the internet and can cover up to 50 kilometres without direct line of sight linking BTS[145]. Furthermore, a microwave technology may be more suitable for extending network for flat and valley topographies while satellite may be preferred for mountainous and isolated geographies.

On the issue of satellite, Interviewee17 pointed out that:

Satellite is not an economic solution in terms of affordability, it may help in solving availability but it is too expensive. Interviewee17

[145]Base Transceiver Stations

This goes to suggest that although satellite may be a good option for isolated areas and, as Interviewee24 articulated, for people living nomadic life as they moving from one area to another in search of pasture for their livestock, it may not necessarily reduce the costs of network deployment.

Interviewees12 and 18 advanced the use of Network Function Virtualisation (NFV). A synthesis of both views indicates that NFV is a technology that helps to lower the cost of infrastructure deployment by reducing the amount of hardware needed to operate and maintain a telecommunications network. For example, to run a GSM network, one would need a structured architecture that encompasses various components such as a given number of BTS connected to BSC[146], which is also connected to a switching centre and so on. With NPV, it is possible to compartmentalise all these processes into a 'single small box' and remotely control and monitor various BTS. So rather than having separate buildings for all these architectures with air-conditioning and other energy costs, the implementation all of these different network functions can be virtually executed through a single piece of computing. Interviewee18 concluded that:

> *This* [NFV] *is one change, which is helping the industry to go to the rural areas. Operators in Africa may want to deploy more of this technology and implement this strategy in serving rural areas.* Interviewee18

One of the implications of NPV is that the costs of running a network could be drastically reduced, as a fewer investment would be required in terms of limited energy and building costs. This is consistent with Han, Gopalakrishnan, Ji, and Lee (2015, p. 90), which asserted that NPV is a low-cost innovation that *"…can potentially bring several benefits to network carriers, dramatically changing the landscape of the telecommunications industry*." This is particularly significant in light of the projection that NPV can reduce capex by 68% and opex by 67% (ACG Research, 2015). Another implication is that local communities can now build their own network with a small amount of investment since NPV is cheap and much simpler to implement relative to traditional GSM technology (Ananth & Sharma, 2017; Han, Gopalakrishnan, Ji, & Lee, 2015. The issue of local communities building their own network is further examined in the next section.

[146] Base Station Controller

The discussion above suggests that in order to achieve effectiveness and efficiency in coverage expansion, policymakers should encourage and promote the deployment of inexpensive and heterogeneous technologies as solely relying on GSM technologies may not be economical in certain disadvantaged areas. Interviewee8 asserted that the choice of deploying various technologies should be weighed against its visibility in other to maximise value for all involved because:

> *The wrong technology deployed for the wrong reasons is equally damaging – it always ends in disappointment for all the stakeholders. The merits of small cell solutions versus a GSM macro site deployment in rural areas should be open for debate.* Interviewee8

In the same light, Interviewee24 concluded that:

> *I believe there is no blanket solution for all countries combined. One needs to see what is there in terms of infrastructure, geography and density in order to decide which policy strategy is best.*

These interviewees suggested that since different conditions exist within countries and between regions, policymakers should talk with stakeholders and collectively decide what kind of technology is best for different locations in terms of its effectiveness and efficiency as highlighted in Section 3.2.2.

7.3.2 Local community enterprise

According to Interviewee1, local community enterprise (LCE) is typically a group of small entrepreneurs who come together to facilitate the ownership and management of telecommunications network to meet the information need of their local communities. Altogether, five interviewees articulated that this kind of 'bottom-up' initiative led by members of the affected communities could help to facilitate low-cost coverage solutions and improve the commercial viability of network expansion in disadvantaged areas. This recommendation is highlighted in the following quotes:

> *…local community enterprise… can put together systems that work. These may not be top quality but for people in isolated villages, some communications are better than no communication. So I don't see why regulation should prevent it as that is regulation working in the wrong way. This is another thing to bear in mind in the African context, community enterprise should be fostered and encouraged and certainly, it should not be illegal.* Interviewe5

> *Some more forward-thinking regulators are even considering new licence models geared specifically to cater for the rural market - small cell solutions with rural villages, village licenses or community licenses. Mexico is pioneering this at the moment while Rwanda is considering this for the African rural market.* Interviewee8

Unlike the MNO who are largely motivated by profit, Interviewee1 added that LCE are primarily motivated by the desire to close the gaps of the socio-economic needs in their local communities. As such, LCE can attract the attention of volunteer experts and NGO who can offer technical and financial support for deprived areas to building a cost-effective network. For example, an organisation called Rise American is building GSM networks with low-cost technology that are community led in Mexico and serving certain communities like Wahaka and Sierra de Juarez. Interviewee1 concluded that in communities like Wahaka:

> *The deployment of low-cost technology has helped to reduce the cost of building a base station to around $6000. This means they can operate on an ARPU of $3 per person and create a sustainable network. This is another new approach using very low-cost technologies operating in the GSM spectrum that can provide sustainable access in rural areas.* Interviewee1

However, Interviewee17 argued that to organise the entire process, one needs a local entrepreneur - somebody in the community who sees a business opportunity or other reasons to bring all parties together. There is also the need to have someone with some level of technical know-how on network deployment and according to Interviewee5, such person can be within or outside the local community who would then carry out 'on-the-job' training for members of the community to take over the management of the network. Interviewees suggested that LCE cannot happen in a vacuum, it needs a concerted effort that is initiated and led by somebody or a group of persons and finding the right mix of people could be a challenge.

Apart from finding someone in the community to lead this initiative, Interviewee1 suggested other key success factors. For example, policymakers should create innovative licence models that would permit LCE to flourish and stimulate solutions that can rapidly facilitate UAS. An innovative idea could be to issue a non-competing licence and establish regulations that will then allow LCE to interconnect with the networks of the larger players at little or no cost, especially for sparsely populated areas as indicated in Section 6.3.2. Secondly, such licence should be technology neutral[147] in order to allow LCE to deploy inexpensive and heterogeneous technologies according to the budget and information needs of a given community. In addition, policymakers can also allocate low-frequency spectrum at no fee considering

[147] Technology neutral is a situation where a single licence is issued to cover the deployment of multiple technology and services (CEG & GSMA, 2012).

that profit is not the main driver for LCE. This can be illustrated with the Zenzeleni Networks, a solar-powered ISP formed by Mankosi[148] community with the technical support of researchers from the University of the Western Cape to provide affordable voice and data services (Tucker, 2017). Zenzeleni was granted a licence fee exemption by ICASA to operate infrastructure and services without charge, however, they pay for backhaul connectivity from wholesale providers with funds from local cooperatives. Zenzeleni offers voice service for 20 cents per minute relative to a minimum of R1.50 offered by MNO, data tariff is '20 to 40' times cheaper and the solar-powered stations provide charging points for mobile phones (Tucker, 2017). This was corroborated by Interviewee27[149], who revealed that *…the community determines the tariff, which is much more affordable than that of the MNO.*

It is also interesting to note that the Internet Society now offers technical and financial support in the range of $10,000 and $30,000 for LCE in emerging economies through its 'Beyond the Net' initiative aimed at providing Internet connectivity for all (Internet Society, 2018). Dodoma District in Tanzania is one example in Africa where the Internet Society is partnering with the University of Dodoma to pilot an LCE network solution using TVWS technology to bring connectivity to unserved remote areas in the region (Metri, 2018b). LCE can thus help to promote a bottom-up initiative with low-cost coverage solutions that are centred on the capacity and the needs of local communities. However, this is dependent on certain factors among which is the permission to deploy a wide-ranging technology and services according to the capacity and needs of a given community. This helps to explain the underlying relationship between inexpensive and heterogeneous technologies and LCE as indicated in Figure 18.

7.3.3 Outsourcing USF projects

Another innovative solution that could help drive the proliferation of coverage in disadvantaged areas is the outsourcing of USF projects to specialised access

[148] Mankosi is a remote community located in South Africa's Eastern Cape Province with a population of about 6,000 (Tucker, 2017).

[149] An ICT academic and rural community network expert, who was part of the team that provided technical support for Zenzeleni Networks

providers[150]. Of the four interviewees that supported this point, two are key figures of a specialised access provider. Hence, one could argue that some degree of 'self-interest' may be at play here relative to the views of the other two interviewees: one civil society advocate and one OTT employee. Having said that, the following quotes help to underline this argument:

What some of the countries have done is quite encouraging like Ghana where Ghana Investment Fund for Electronic Communication (GIFEC) actually give money to local companies to go and buildout networks in certain villages. Interviewee12

One good model is what people are doing in DR Congo when small companies are contracted to deploy mini BTS… powered by solar. These small companies are responsible for the installation and management of these BTS and there is a revenue-sharing model between them and MNO. Interviewee4

The main argument here is that specialised access providers are better placed to deploy networks to deprived areas as they have the know-how to implement low-cost solutions and technologies to meet the telecommunication needs in such locations. Interviewee8 asserted that the costs of deploying coverage to disadvantaged areas using traditional GSM solutions can be significant with a typical GSM tower costing between $122,000 to $150,000 of capex[151]. This is excluding opex like energy costs from generator sets and diesel, which Interviwee13 said cost between $6,000 to $7,000 on average a month to maintain a single BTS. Interviewee8 asserted that when this is compared with the deployment of solar-powered small cells towers that cost between $75,000 to $50,000, it becomes apparent that this is a fundamental 'game changer'. Interviewee8 further added that specialised providers not only provided a sustainable network access for disadvantaged areas but also facilitate access to other value-added services such as health, education, agriculture and mobile money. Interviewee12 also shared this sentiment by adding that:

I think it is simply possible to make any rural coverage profitable to deliver mobile services. If it is 10 people living in a hut, probably not but anywhere from a community where you can get 100 users, you can make it work. There are small cell technologies; the price of satellite bandwidth is cheaper, solar energy is becoming cheaper and widely spreading. So it is possible. Interviewee12

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[150] These are niche providers such as, for example, Africa Mobile networks and Connect Africa (AMN, n.d.; Connect Africa, n.d.)

[151] This is somewhat consistent with Otieno (2018) who appears to suggest that CA is planning to spend around $838,000 of USF on 6 BTS in disadvantaged areas in Kenya, which amounts to about $140, 000 per BTS.

Interviewees suggest that this initiative could either be funded with money from USF or entirely by the specialised provider. Under the first option, policymakers outsource the buildout of infrastructure to specialised providers using funds from USF and after the project is completed, it is then handed over to MNO to operate and manage. Section 3.4.4 indicates that DRC, Cameroon and Ghana are among the few countries in Africa deploying USF through this strategy.

The second option is not supported with USF but rather, the specialised providers fund, manage and operate the infrastructure buildout by themselves. In order to connect users in such locations to the wider reach of the country, they negotiate a revenue-sharing agreement with MNO who then integrate them into their networks. According to Interviewee12, they typically propose a 50:50 revenue sharing agreement. Although this model presents an opportunity to economically expand coverage without the use of subsidy or direct investment from MNO, it has failed to gain traction due to the difficulty of negotiating commercial agreements with MNO. This is reflected in the comment made by Interviewee8:

We proved the technology, we successfully built and operated this rural solution as a trial for two years with MTN, and we have negotiated with other operators, all of whom were happy with the functionality of the equipment, but we could not get past commercial agreement.

7.3.4 Over-the-top players

A further innovative solution that emerged from the data that could contribute to the improvement of UAS is the activities of over-the-top players[152] (also referred to as OTT). However, the comments from the 15 interviewees that contributed to this discussion indicated that the issue of OTT could be very divisive because while some agreed that the initiative has a role to play in promoting UAS, others disagreed. The following interview excerpts serve to illustrate the arguments from both sides of the debate with the first two comments arguing in favour of OTT while the last two are against:

In my opinion, this is just another example of innovation. I think it is great. I think anything that finds an innovative way of funding mobile connectivity and communication is good. I know there are concerns about how it is not the full

[152] OTT players refer to online content providers like Facebook and Google who use internet protocol to transmit telecommunication services like multimedia, text and voice to mobile users over private and public networks (CTO, 2016; Gillwald et al., 2016).

internet; there are commercial issues with Facebook having privileged access to people's data and so forth…Interviewee17

…Google is introducing Wi-Fi access points into some of the larger African cities like Kampala. Such activity is opening up social media and VOIP for people in areas that did not previously enjoy data coverage and it is being made affordable. Microsoft and its TV White Space initiative is looking into $2-$3 per month for unlimited data access. In other words, using a very low-cost spectrum to provide coverage across Africa. Interviewee8

I don't believe in zero rating based on what I have said earlier: it needs to be a sustainable business solution and giving people something for free which has a value doesn't make it economically sustainable… I think it gets a good press for people like Facebook and Google but it is completely long-term unstainable. Interviewee12

Well, the claim these big tech giants make is no doubt for their own reasons and there is nothing wrong with that as such entities exist to make money… if they can bring cheap technologies, if they can offer something which is easier and affordable for people living in unserved and underserved areas, then that will be beneficial. So far, we have not seen anything like that… Interviewee23

The views advanced by interviewees from both side of the argument would suggest that there is a wide-ranging issue while some would support OTT and others would not. One of the reasons why some interviewees advocate for OTT is that some of their activities contribute to the spread of heterogeneous telecommunications infrastructure. For example, Google's Project Link in Kampala, Uganda that involves the deployment of affordable fibre network and Wi-Fi wholesale access (Google, n.d.; Mutegi, 2015). Interviewee23, however, voiced disquiet that such initiative is limited to a few countries and cities, not necessarily in deprived areas where the efforts of UAS are needed the most. A second reason advanced by interviewees in favour of OTT is that they help to drive the innovation of telecommunication services including social media, which are widely used by people for communication and other value-added services. For example, while 63% of internet users in Middle East and Africa use WhatsApp, over 90 million people use Facebook across Africa (ITNews Africa, 2016a; Statista, 2017). Tully and Ekdale (2014) also found that a growing number of people in Kenya use OTT like Twitter to express their opinion and contribute to debates that may affect their lives. The third reason is that OTT promote affordability, which was highlighted as one of the major impediments to the adoption of mobile telephony in Africa, significantly for data tariffs (Section 5.3.4). This is illustrated by

OTT activities such as 'zero-rating'[153], which allows mobile users in over 20 African countries such as South Africa and Zambia to access limited contents such as WhatsApp and Facebook without data charges (Jackson, 2014).

Conversely, other interviewees, including Interviewee16[154], opposed OTT not necessarily on the grounds that they do not contribute to UAS but that such effort may not be substantial. For example, OTT effort to improve physical infrastructure is rather limited to a few countries like Microsoft 4Afrika TV White Space project in Tanzania and Google' Project Link in Uganda (Microsoft, 2016; Mutegi, 2015). As such, Interviewee13 stated that they are against OTT as they derive value from the infrastructure provided by others with little or no contribution:

> *It* [OTT] *is a good example of what innovation can do… When you look at it from a telecom landscape, there is a problem. We have operators like us who are spending millions of dollars to invest in infrastructures, on the importation of handsets, to make sure that we have networks that are able to convey broadband signals… Then you just have these applications that bypass your systems and suddenly it is contributing to you losing revenues… we effectively have a partnership with OTT but it does not mean that we agree on everything because social media drives usage and it increases data revenue.* Interviewee13

Apart from the fact that they utilise infrastructure with little or no contribution, OTT activities such as zero-rating also contribute to the loss of revenue for MNO as illustrated in the claim of MTN Nigeria (Adepoju, 2017d). This is because the use of OTT platforms such as WhatsApp can provide users with more affordable access to telecommunication services like voice and messaging, thereby limiting the ARPU that would have accrued to MNO. Interviewee10 also expressed their disquiet about the perceived lack of clarity and transparency of OTT:

> *We have some* [OTT] *coming to ask for areas lacking coverage and for TV White Space. But when you see their model, it is not yet clear what they are trying to achieve.*

Interviewee10 argued that this of lack clarity and transparency might result in a lack of support from other stakeholders in the industry because although the intentions of OTT appear 'good' on the surface, some of their initiatives seem to lack a clear action

[153] Zero-rating is the practice whereby MNO in partnership with OTT, exempt mobile users from data charges for selected content (Curwin, 2015).

[154] A senior figure of a civil society organisation with over 20 countries

plan. Hence, their request for regulatory support like TV White Space to serve disadvantaged areas has failed to gain traction.

Consequently, it was suggested that since OTT involvement in UAS is a new phenomenon, more observation and research are needed to unravel the concerns from various quarters. According to Interviewee24:

It's [OTT] *quite a recent phenomenon and very controversial. Perhaps more research is needed, especially by the economists because I think it's very important to calculate exactly how many benefits accrues to each party – users and providers – and who is worse off?*

Concerning the issue of 'who is worse off', there was a consensus among interviewees from both sides of the debate that regardless of the role of OTT in UAS, the protection of users against any form of abuse is critical. The statement of Interviewee6 helps to articulate this point thus:

…countries need to establish effective data protection agencies to forestall the abuse of platform operators and protect the people. Interviewee6

This recommendation comes against the backdrop of OTT gathering user information to create personalised data for targeted advertising by third parties without making it explicitly clear to users that this would occur (Irion & Helberger, 2017). However, considering the complexity of the internet and the fast-changing nature of technology and services, regulating OTT may be a very difficult task for regulators (Bauer & Knieps, 2018).

7.3.5 Relevant local content

Five interviewees argued that promoting the proliferation of relevant local content would help to encourage ICT/mobile adoption and usage. The following interview extracts help to underline this argument:

...people may be more interested in the adoption of these services, regardless of the challenges bedevilling them if contents are more localised. Nowadays, the internet is filled with contents but localised, specific contents, which can be easily understood and created for specific needs of a given community, are not widely available. Interviewee23

So the issue about remote areas profitability is just about the business model… we have to think about a number of things including relevant content… because the perception today is that those places are not viable but when you fine-tune your business model, you can make it viable - you have to give them a product that they understand… and they also need to be educated on how to use it. A megabyte does not mean anything to my mother, but if you tell her that 'with a megabyte,

you can watch… a film from your village and it can last for x number of days, you can call your son on Skype for 30 minutes a day for a week, etc.,' then it begins to make sense to her. Interviewee13

This group of interviewees suggested that relevant local content means the availability of telecommunication services that address the information needs of a group of people. As such, telecommunications become not only attractive but also useful for the improvement of personal and professional lives of people. For example, added Inteviewee23, the best video that teaches a farmer how to farm in a modern way is the video that is recorded with the local contents of the African people, not the one made in Europe for the European farmers. This could be for fisheries, poultry and cattle farming. Apart from making technology relevant to farming, Interviewee5 asserted that mobile money services like M-PESA in Kenya could be used to promote local content to capture the interest of people living in disadvantaged areas without access to traditional banking platforms. This sentiment was also shared by Interviewee10 who stated that:

…the introduction of mobile money has been a key driver for mobile phone usage in rural areas. Interviewee10

Both interviewees argued that not only would this encourage mobile adoption, it could also act as incentives for MNO to expand their footprint as mobile money has the potential of increasing their ARPU. For example, MNO may get the transaction revenue for mobile money on top of the normal mobile revenue. Lessons can be drawn from the operation of MPESA in Kenya as highlighted in Section 1.2. Furthermore, Interviewee19 stated that:

Just because you have access, in theory, doesn't mean that the internet is useful to you or that you can use it effectively… Just because ITU, GSMA and everybody have kind of accepted it doesn't mean that it is right. We might just say that 'look, everybody is living under a tower so our work here is done.' I am concerned that is not the case. Interviewee19

In other words, it is not sufficient to deploy networks, MNO and policymakers need to promote ICT/mobile adoption and usage by providing useful services and educating people on how to use technology as they evolve (Nsengimana, Kende, & Rose, 2015). It also interesting that Interviewee13 quoted earlier linked the improvement of the viability of disadvantaged areas to a business model that reflects local content in terms of services that can address the information needs of people. One of the key components of this, added this interviewee, is engaging with people in a given

geography in order to co-create content that could impact their lives, because local content *…in Nigeria, for instance, may be different from local content in South Africa* (Interviewee13). Drawing from exploring 15 villages in rural DR Congo, Champion, Cibangu and Hepworth (2018, p. 18) concluded that co-creating content with users require a great deal of partnership and end-user engagement, which will then allow relevant content that reflect *"…local cultural views, specific beliefs, needs, or realities of …"* users to emerge.

In summary, policymakers, MNO, content providers and other key decision makers in the industry need to start seeing the creation and promotion of relevant local content as one of the key components for achieving UAS and embedded in this is digital literacy. The more local content is created, the more people are likely to engage with technology and this translates to more adoption, which then encourages the industry to push coverage beyond big cities and towns. This further underlines the argument made in Section 6.2.1 that the traditional principles of UAS need to be extended to include assessment (finding out the telecommunication needs of people) and awareness (informing people of the importance of using technology and educating them on how to use technology as it evolves).

7.3.6 Anchor customers

The last form of the innovative solutions suggested by four interviewees is the commitment of private and public institutions to act as 'anchor' customers for the consumption of telecommunication services as reflected in the following comments:

> *Another way is to encourage the adoption and usage of telecom services through government services, i.e., E-government is a very good tool as it will generate traffic for the operators and create services for the people so that they will travel less to the cities to access and pay for government services. In this way, government becomes the so-called anchor customer…* Interviewee23

> *In a place like New Zealand… Their model is that government subsidises a fixed fibre connection to a base station in the village, they connect schools to it including library and any other government institutions first. In this way, through the government, it has some demand and then mobile operators can then use the same base station to provide services to individual households…* Interviewee6

The aim of having an anchor customer is to create a situation where institutions act as 'guaranteed' customers to reassure MNO that they would serve as 'minimum' capacity users of deployed infrastructure and services. Interviewee23 suggested that government, as an institution, could act as an anchor customer in two ways. Firstly,

through the digitisation of public institutions and rendering service through electronic platforms such as mobile phones and computers. This would then encourage ICT usage/mobile adoption, boost aggregate public demand for telecommunication services and contribute to the bottom-line of MNO. Examples of such services include online utility payments, an electronic application for driver licence and engaging with farmers via text messages. Secondly, government could also act as an anchor customer through the utilisation of telecommunications infrastructure as illustrated with the case of New Zealand by Interviewee6 above.

Interviewee26[155] also commented that *"…Zambia is trying to set up internet facilities in post offices across the country as anchored customers to encourage adoption of ICT."* Interviewees further added that government can work with MNO to provide connectivity for other public institutions such as schools, public libraries, local government offices, clinics and police stations. Such initiative would create some level of assurance to MNO that when they deploy coverage to disadvantaged areas that are perceived to have low demand, minimum capacity utilisation from government institutions would help to generate some revenue. This could increase over time as people living in such communities may be attracted to take up their own services having been introduced to technology through schools and workplaces connected by the government. Such actions would also help to ensure that telecommunications infrastructure does not become redundant as result of low capacity usage.

The discussion above suggests that the thinking behind institutions acting as anchor customers is in some ways linked to relevant local content in the sense that to attract anchor customers, MNO have to provide relevant services. On the other hand, digital education appears critical in order to ensure that the institutions that are connected see the importance of technology in making their work easier and employees need to be trained on how to use the platforms that have been provided. People also need to be educated on changes to service delivery and how to navigate digital platforms to access public services. This helps to illustrate the link between relevant local content and anchor customers as indicated in Figure 18.

[155] A senior employee within one of the Ministry of Transport and Communications in Africa

7.4 Conclusion

This chapter and the previous one address RQ2 by presenting the various suggestions offered by interviewees on how to mitigate the digital divide of uneven mobile coverage in Africa. Since these findings emerged from the problems identified in Chapter 5, the discussion in Chapters 6 and 7 has been presented in a manner that clearly highlights the interaction between issues. Following the argument that regulatory capacity and transaction costs are the two key underpinning issues that help to explain why digital divide persist across Africa, Chapter 6 highlighted how a lack of regulatory capacity could be tackled. Chapter 6 also indicated how to mitigate the issue of transaction costs through, for example, incentives. Chapter 7 continued by further exploring other costs reduction strategies. For example, interviewees recommended the issuing of technology-neutral licence to encourage the deployment of a mix of technologies to serve disadvantaged areas so much so that small and large operators will have the liberty to deploy heterogeneous networks based on cost efficiency and the needs of a given community. This will help the industry to move away from solely relying on expensive traditional technologies like 3G, 4G and advance a combination of inexpensive technologies such as Wi-Fi, WiMAX and VoIP to bring connectivity to commercially unviable areas.

There were various dynamics within the recommendations of interviewees as typified by, for example, infrastructure sharing. While there was a consensus among interviewees that infrastructure sharing among operators could help to lower the overall costs of network deployment, opinions were split on the impact it has on disadvantaged areas. The reason being that although sharing generally reduces the cost of deployment, it does not necessarily change prevailing circumstances such as sparse population density, low ICT usage and low-income levels in disadvantaged areas. Figures 15 to 18 further illustrates other dynamics and various interactions between the issues that were raised. Therefore, consistent with Chapter 5, it is evident from Chapters 6 and 7 that the issue of regulatory capacity and transaction costs are two fundamental underpinning issues that need to be addressed by various countries in Africa in order to close the digital divide. These two fundamental issues are further analysed in Chapter 8.

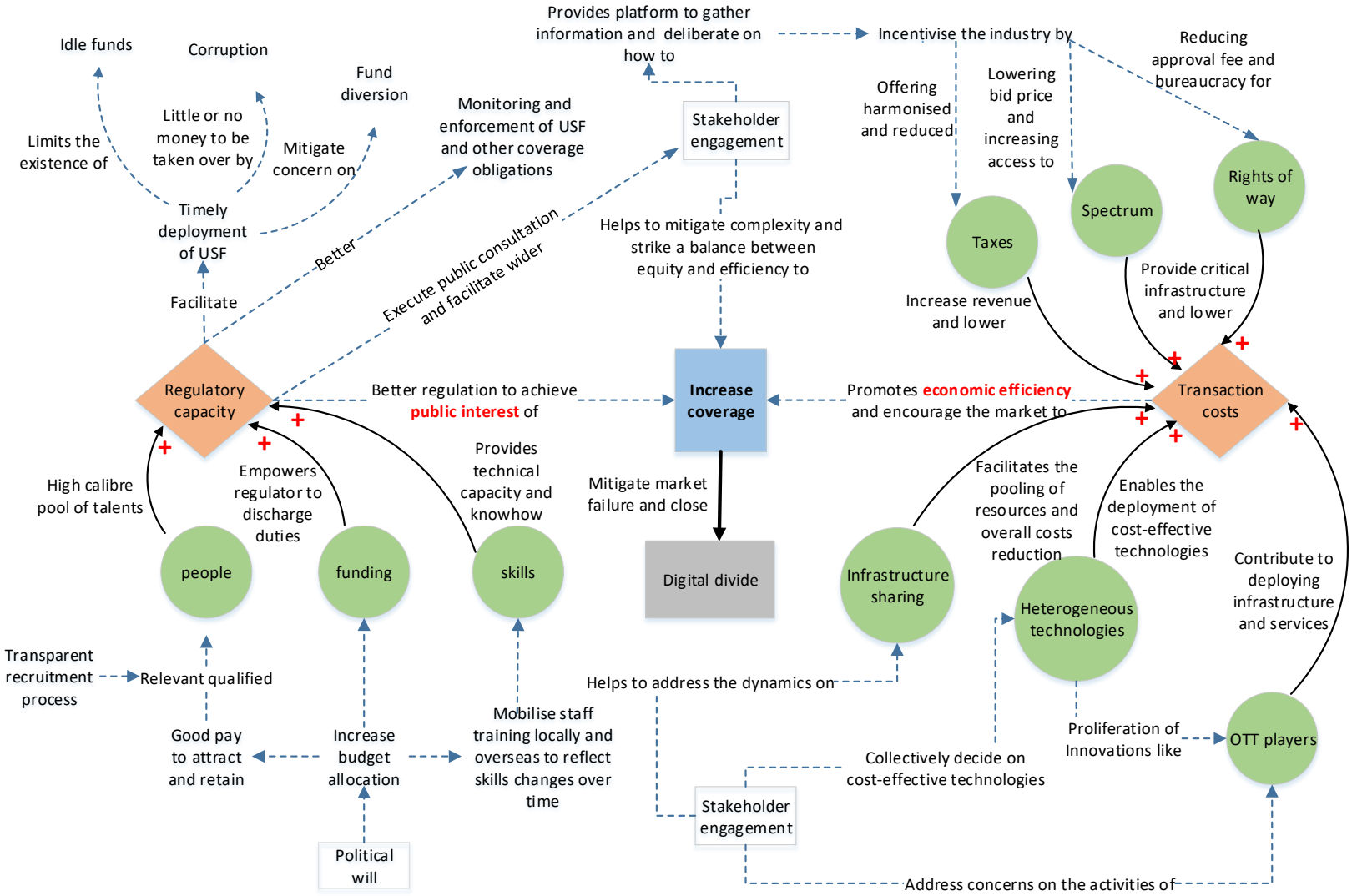
Chapter 8: Discussion

8.1 Introduction

Similar to various studies (for example, ITU, 2017a; OECD, 2008; Thakur & Potter, 2018; UNCTAD, 2008; Urama & Ogbu, 2018; World Economic Forum., 2014), interviewees agreed that widespread access to telecommunications can be transformative and critical to the socio-economic development of any country. Despite this consensus, Chapter 2 showed that pockets of digital divide persist across Africa with a projection that over half of the continent's population is either unserved or underserved. While Chapter 5 highlighted a wide range of issues as to *why* digital gaps persist across Africa, Chapters 6 and 7 provided insights on *how* to mitigate the issues identified in Chapter 5. Drawing on the public interest and economic efficiency perspectives of market failure in Chapter 3 and the depth of the interaction between the data in Chapters 5, 6 and 7, this chapter identifies two key underpinning issues of **regulatory capacity** and **transaction costs** to develop a model for closing the digital divide in Africa. Figure 19 highlights this model along with the dynamic of how issues interact to mitigate the market failure of uneven mobile coverage.

For example, one of the findings from Chapter 5 highlighted a lack of strong ICT leadership and commitment as one of the themes that help to explain the impediments to the implementation of USF in Africa. The discussion that follows suggests that the issue of regulatory capacity is at the heart of this theme as depicted in Figure 12 in Section 5.2. Fifteen interviewees asserted that although regulatory capacity is critical to the implementation of USF in advancing widespread access, African regulators are generally faced with a lack of capacity. It came to the fore that when this happens, it tends to have a ripple effect on the ability of a regulator to formulate robust UAS policy (Sections 5.2.3 and 5.2.4), monitor and enforce mandates as well as effectively and efficiently deploy funds in a timely manner (Section 5.2.2).

Figure 19: Model for closing the digital divide in Africa



Such a delay in the implementation of USF leads to the accumulation of idle funds (Sections 3.4.5 and 5.2.5), which then leads to the issue of corruption where those responsible for administering the funds can divert them for their personal use (Section 5.2.6). Figure **Error! Reference source not found.**9 indicates that a timely d eployment of USF could help to overcome the challenges of idle funds, corruption and fund diversion. However, contrary to the assumption that regulatory intervention in the event of market failure is costless (Section 3.2.3), for a timely deployment of USF to happen, human and financial resources are needed to help regulators achieve this feat. Figure **Error! Reference source not found.**9 also highlights that the availability of such resources is vital to help regulators monitor and enforce USF and other coverage obligations. This is significant in light of the fact that the absence of monitoring and compliance can make regulatory instruments susceptible to subversion and unscrupulous actions by market actors (Sections 3.2.2 and 5.2.2). This helps to illustrate that regulatory capacity is a fundamental issue that feeds into the bigger picture of unravelling the reasons why digital divide persists across Africa.

Although the use of subsidies such as USF is popular among policymakers in Africa, Section 3.2.2 argued that regardless of the regulatory instrument of choice, attention needs to be focused on its effectiveness and efficiency (Gillingham & Sweeney, 2010). This can be achieved in a liberalised market by designing a regulatory instrument that not only ensures equitable access to telecommunications but also promotes economic efficiency (Ortiz, 2016; Stiglitz, 2010). This is significant following the argument that, for government to achieve the equity objective of providing UAS, it needs the cooperation and participation of market actors who are actually responsible for the deployment of infrastructure and services (Anker, 2017). However, of all the causes of market failure examined in Section 3.2.1, Section 5.3 suggested that the transaction costs of network deployment and maintenance act as a disincentive for MNO participation as this is the most significant factor that limits the economic efficiency of coverage expansion. Apart from the fact that telecommunications is a capital-intensive sector, the general lack of supporting infrastructure across Africa, especially electricity and roads, substantially increases the costs of deploying network and services in the continent (World Bank, 2018a; 2018b). This discourages MNO from investing beyond commercially viable areas -

underlining the argument that transaction costs are a 'root' cause of market failure (Todorova, 2016; Williams, 1985).

Hence, as various policymakers formulate UAS policy to promote widespread access to telecommunications, Chapters 6 and 7 argued that they should also look for ways to lower transaction costs to encourage operators to participate in coverage expansion and build a wider support for digital inclusion. Although Chapters 6 and 7 presented series of recommendations that could help to reduce transaction costs, Figure 19 illustrates that such reductions could be achieved through incentives such as taxation and encouraging collaboration like infrastructure sharing. The key message from Figure 19 is that UAS policy should be formulated in a manner that empowers regulatory authorities with adequate resources to promote widespread access to telecommunication services and, at the same time, facilitate economic efficiency in order to make it feasible for MNO to economically provide infrastructure and services. This would allow a joined-up solution for tackling digital divide to emerge and pave the way for a regulatory instrument(s) that maximises social gains and minimises transactions costs (Coglianese & Lazer, 2003). Hence, the reason for synthesising a definition of market failure that accounts for both equity and efficiency in Section 3.2.

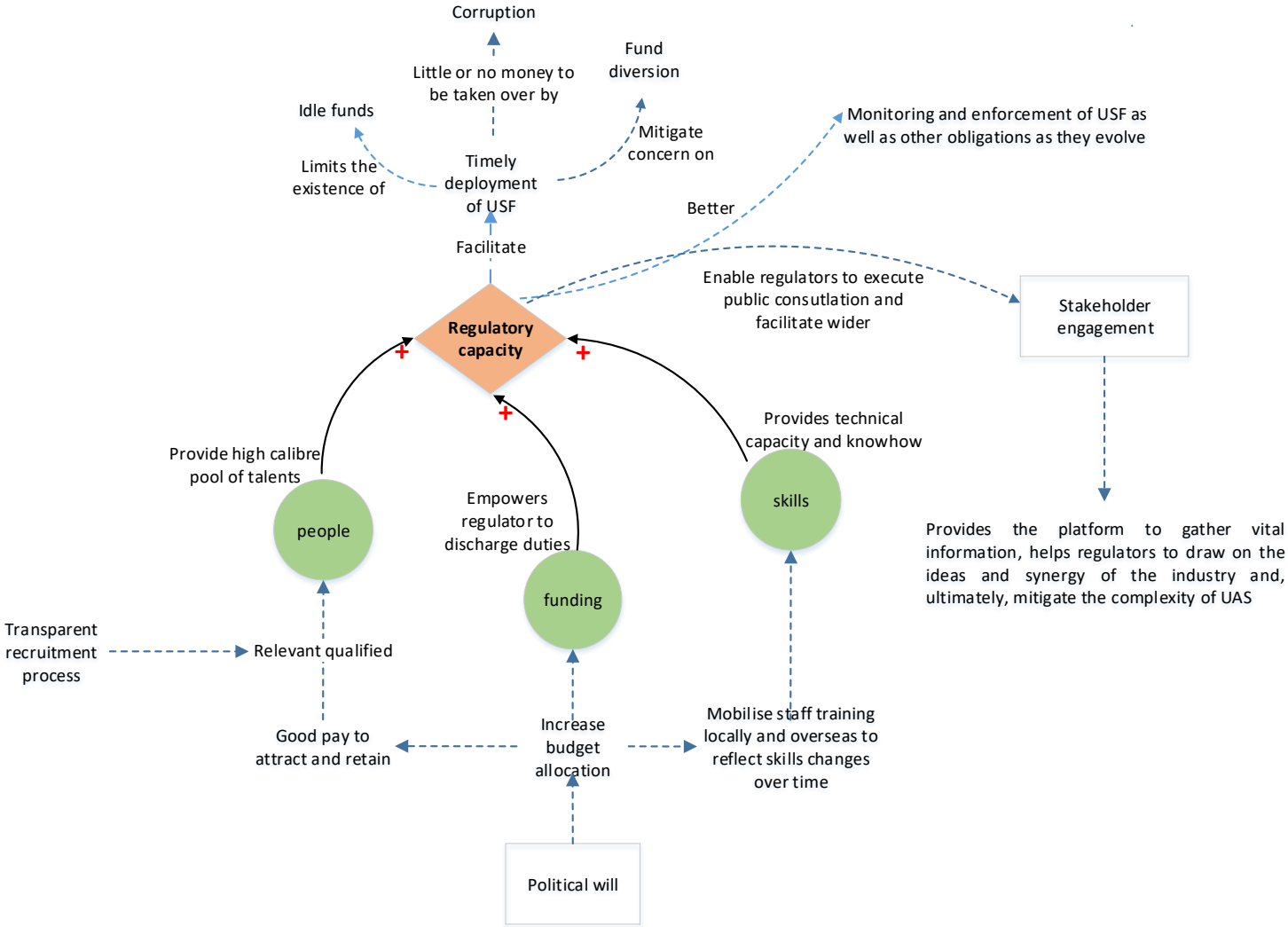
Achieving such a balance could be a complex and daunting task as there is a difficult tradeoff between promoting competition (efficiency) and simultaneously committing to UAS (equity) (Rob, Tausha, & Vilakazi; 2017; Trubnikov, 2017). Longstaff (1996) thus argued that many countries around the world have failed at their attempts to find a balance between equity and efficiency. Figure 19 indicates that working with other stakeholders in the industry can help to mitigate such complexity by, for example, leveraging on the skills and experience of a wide range of actors to provide synergies that are beyond the effort of isolated policymakers. As will be seen in Section 8.3, in addition to deploying USF to promote widespread coverage, policymakers across Africa have begun engaging with operators to promote the economic efficiency of coverage expansion. For example, NCC support for MTN Nigeria to secure rights of way (Section 8.3.1.3), NCA offering free spectrum frequency in 900MHz to MNO willing to deploy 3G to disadvantaged areas in Ghana (Section 8.3.1.2) and South Africa's treasury announcing the alignment of its telecommunications tax to ease the burden on the sector in order to encourage more investment in fibre optic infrastructure (Section 8.3.1.1). Such governments effort,

albeit limited, indicate that as difficult as it may be to square the tradeoff between equity and efficiency in the event of market failure, where there are strong leadership and political will from policymakers to engage with the industry, there is a way (Shenglin et al., 2017). Therefore, drawing on the interaction between issues in Figure 19, this chapter argues that addressing concerns around regulatory capacity and transaction costs would go a long way in helping to close the digital divide across Africa. To this end, using fragmented data maps from Figure 19, Section 8.2 examines regulatory capacity while Section 8.3 explores issues around transaction costs. Section 8.4 concludes the chapter.

8.2 Regulatory capacity

Contrary to the assumption in Section 3.2 that government intervention in the event of market failure is costless, 15 interviewees in Chapter 5 asserted that to address market failure from a public interest perspective, a regulatory authority needs to be well-resourced. This allows it to formulate viable policies, implement and police mandates to ensure compliance. Figure 20 indicates that when a regulator is well-resourced, the impact appears to be dynamic just as a lack of it has a wider effect on the overall direction of UAS.

Figure 20: Addressing market failure from a public interest perspective



For example, adequate regulatory capacity will ensure that a regulatory authority has the sufficient and qualified staff to formulate robust policy for UAS, which, in turn, will address the issue of policy imitation and the narrow scope of USF identified in Sections 5.2.3 and 5.2.4. The regulator will also be empowered with the necessary skills to deploy USF in a timely manner, which will then allay the concerns raised by idle fund, corruption and fund diversion (Sections 5.2.5-5.2.7). Furthermore, the regulator will have the required capacity to monitor and enforce policy compliance, conduct and organise stakeholder engagement and, ultimately, reduce the complexity associated with UAS (Section 5.4) by drawing on the ideas and synergy of the industry.

While the examples above help to illustrate the complexity and interaction between issues, a further analysis and triangulation with the literature and country examples indicate that addressing market failure from a public interest perspective is not that straight-forward. Figure 20 shows that the dynamic within the issue of regulatory capacity can be explained from three standpoints: the availability of *people*, in terms of access to qualified staff, *funding* and *skills*.

8.2.1 People

Evidence from Chapters 5, 6 and 7 indicates that the deployment of USF to address market failure in telecommunications requires qualified staff to administer and manage the process, who in some countries are in limited supply. Interviewees argued that since regulatory authorities generally offer lower salaries compared to private corporations, they find it difficult to compete, attract, and retain people with the relevant skills. This results in high labour turnover and staff shortages, which restricts the ability of the regulator to carry out its functions (Marcelle, 2004; Sacks & Levi, 2010).

The problem of low pay can be illustrated with the case of South Africa where the staff of ICASA accused the government of neglecting the agreement they reached following a strike action in 2016 to protest against 'poor' working conditions, including the inconsistencies in their salaries (Mzekandaba, 2016). The recently suspended CEO of USAASA[156] has also been accused of reducing the salary of the

[156] Mr Lumko Mtimde

company secretary with the aim of undermining her authority (Mcleod, 2018). Although pay packages are determined within the wider context of the civil service, it is somewhat surprising that staff working for regulators like ICASA are protesting against low salaries considering the contribution made by the telecommunications sector to the wider economy across Africa (Section 1.2), and the substantial amount of money generated from USF levies (Section 3.4.3). Such protest is also inconsistent with the argument that 'reputable' government departments contributing more to the economy tend to be better rewarded financially (Posner, 1974).

Figure 20 indicates that if governments want to make the regulator attractive like the private sector, they should provide better salary to attract and retain relevant qualified staff that will enable the regulator to discharge its duties. Interviewees further added that better pay for regulatory authority would help to reduce corrupt tendencies in the sense that people are currently being paid little relative to the large amount of money they manage in USF. Furthermore, the literature highlighted that, the industry has large financial resources and, as such, can 'capture' the intervention process (Hantke-Domas, 2003; Hertog, 2010; Posner, 1974). Interviewees asserted that a well-paid regulator can have a bit more clout and stand-up to 'rent-seeking' interests, resists being captured and ensure better monitoring and enforcement of USF to increase equitable access to telecommunications as highlighted in Figure 20.

While interviewees have made such recommendations by drawing on their experience across Africa, it seems not to have accounted for the issue of political capture raised in the literature (Section 3.2.2). This is exemplified in the case of Rwanda where evidence indicates that although the qualification and experience of the Board of RURA appear exceptional compared to its peers in Eastern Africa, the Cabinet and the Ministry of Youth and ICT tend to override the decisions of the regulator (Section 2.2). For example, although RURA shortlisted four firms - Millicom, Zain, Larrycom, and Telecel Globe - in the process of issuing the third GSM licence in Rwanda in 2008, the final approval of Millicom for a 15-year GSM licence for $60M was done by the Cabinet (Balancing Act, 2008; ITNews Africa, 2008a). This appears to be inconsistent with Chapter III, Articles 5-14 of Law 44 of November 30, 2001, which states that the regulator shall be 'independent' and empowered by law to award GSM licences (RURA, 2015).

The same pattern can be observed in South Africa where the Telecommunications Act of 2000 prescribes that ICASA is 'independent' but the sector ministry often interferes in its activities. One of the latest examples of this is the legal tussle between the Ministry and ICASA over auction and allocation of spectrum in bands 700MHz, 800MHz and 2600MHz (Telecompaper, 2017b). The reason behind this impasse is that the Minister wants the allocation done via Open Access Network while ICASA insists on allocation through auction (TeleGeography, 2017c). The impact of political capture is also reflective in the inability of ICASA to implement Local Loop Unbundling (LLU) along with the assignment of spectrum for the improvement of broadband in South Africa (Hawthorne, 2015). This is due to the action of the government in 'protecting' the state-owned Telkom from competition and, as such, broadband speed is not only slow in South Africa, there is also affordability problem (Hawthorne, 2015; 2018). In this case, it is not necessarily the lack of staff that is holding back the implementation of LLU in South Africa, but political interference.

These examples suggest that whilst it is critical to provide attractive salary for a regulator to attract and retain qualified staff, such staff should also be allowed to act independently and bring their skills and experience to bear. Figure 20 indicates that this requires a great deal of political will on the part of the government to allow the professionals they have appointed/recruited to run the affairs of the regulator without political interference.

8.2.2 Funding

Chapter 5 highlighted that regulatory authorities are often under-resourced government departments with limited budgetary allocations to execute their regulatory functions. This is illustrated by the cases of Mauritania, Uganda and South Africa (Attenborough, Koch, Maiorano, & Miller, 2004). The study found that the regulators in these countries are faced with various budgetary constraints. For example, although the budgetary allocation approved by South Africa's Parliament for ICASA has increased over the years, the enormity of their regulatory functions, including the costs of litigations, have placed a greater burden on its financial resources. In 2014, ICASA's budget approval was R382 million compared to R461 million in 2015 (ICASA, 2015). The figure for 2016/2017 shows that from a budget proposal of R1.4 billion, the Parliament only approved R430 million (Mzekandaba, 2017b). While the

reason behind this reduction is not clear, it does illustrate that the budget of ICASA has been reduced by 6.7% between 2015 and 2016.

In the case of Mauritania where they have adopted a multi-sector approach to UAS (Section 6.3.4), the personnel of APAUS is drawn into multiple projects in telecommunications, electricity and water. The implication of this is that the resources of APAUS are stretched beyond capacity and the country is largely reliant on funding from the World Bank's Telecommunications Sector Project, which began in 1999 with $12 million (Attenborough, Koch, Maiorano, & Miller, 2004; World Bank, 2004). Lastly, in the case of Uganda, UCC has been required to contribute to the servicing of a loan originated by the Ministry of Finance, leaving UCC with limited funding to perform its regulatory functions (Attenborough, Koch, Maiorano, & Miller, 2004). Although these case studies were conducted over 10 years ago, the findings are consistent with current practice as highlighted in Section 5.2. Zambia has a more recent example where Mr. Edgar Lungu[157] issued a directive to reduce funding for ZICTA (Malakata, 2017b). While Mr. Lungu argued that this is meant to 'transform' the regulator into a profitable institution that is capable of contributing more to the treasury, critics argued that such action leads to the defunding of ZICTA (Malakata, 2017b). Others argued that this would limit the ability of ZICTA to formulate and implement policies aimed at increasing mobile coverage and adoption of ICT (Malakata, 2017b).

Interviewees stated that in countries where this happens, there is very little the regulator can do and this can lead to a whole raft of problems as identified in Chapter 5. For example, a regulator may be forced to curtail the process of allocating USF due to a lack of capacity, which then leads to the accumulation of funds (Section 5.2.5). The accumulation of funds encourages corruption and the disruption of USF as evident in South Africa (Section 5.2.6) and fund diversion (Section 5.2.7). Recent cases of fund diversion can be found in Kenya and Zimbabwe. The president of Kenya recently 'ordered' CA to give around $10 million of USF money to support the police in their campaign against cyber-crime (Matinde, 2018a). A move that has been condemned by civil society who argued that this is not the purpose of USF (Matinde, 2018a). The government of Zimbabwe has also diverted $172.9M of USF money to fund the

[157] Edgar Lungu is the current president of Zambia.

digitisation programme of the state TV station, including an additional $10 million to partly fund the $40 million acquisition of a 60% stake in Telecel from VimpelCom (Karombo, 2016; Telecompaper, 2016). Econet, the market leader in Zimbabwe, condemned this move saying that it erodes the accountability and outcome of USF (Telecompaper, 2016).

This underlines the argument made by some interviewees that regulators are not getting enough support from governments in terms of empowering them with the financial resources they need to discharge their duties. Figure 20 thus indicates the need for policymakers to increase budget allocation to provide regulators with funding and empower them to discharge their duties. Although some interviewees called on governments to stop diverting USF money if meaningful progress is to be made in closing the digital divide, others also acknowledged that some governments might continue to do this, particularly during an economic downturn. Section 1.2 also highlighted that government across Africa are becoming heavily reliant on revenues from telecommunications sector to fund national budgets.

8.2.3 Skills

The last aspect of regulatory capacity is skills. It was highlighted in Section 5.2.1 that although it is critical for regulatory authorities to have personnel with the right skill sets, it appears that regulators in Africa are generally faced with skills shortages. This problem of skills shortage tends to mirror a wider government challenge in the sense that without personnel skilled in economics, legal, organising and technical issues, the whole process of UAS will be under threat. For example, the formulation and implementation of any form of intervention require a considerable level of information in order to help policymakers locate areas of market failure, determine the level of resources needed and execute an action plan (WTO, 2006). Having people with the relevant skills sets is critical to organising and sourcing such information. Furthermore, administrative and technical skills will be required to comprehend appropriate regulatory instrument, quickly identify projects and design solutions, improve policy over time and communicate with other stakeholders in the sector (Gillwald, 2005b; ITU, 2013b).

More often than not, such skills are limited in developing countries (Sacks & Levi, 2010; WTO, 2006). For example, while the regulator in Uganda was found to be

adequately staffed, it particularly lacked personnel skilled in the matters of economics and negotiations (Attenborough, Koch, Maiorano, & Miller, 2004). For countries where such skills are lacking, the regulators run into different difficulties as identified in Section 5.2. This can also result in the deployment of a regulatory instrument that is not fit for purpose in terms of its suitability for a given market (Nzepa, 2005: 165). Hence, UAS may lack a clear direction and fail to meet the equity objective of promoting widespread access to telecommunications.

Some countries have attempted to overcome this difficulty by enlisting the services of consultants. While some countries have benefited from this strategy, it appears not to have fully addressed the problem as UAS consultants suggested that their skills are bespoke and difficult to transfer within a short period. For example, an independent consultant was hired to conduct an access gap cluster model in Nigeria in 2014, another was hired for access gap mapping and to update USF Operation Manual in Kenya in 2015 (Dymond & Oestmann, 2015; Iftikhar, 2014). South Africa has also adopted a similar approach in building the capacity of the regulator and whilst there has been some level of improvements, skills gaps persist in the areas of economic and legal analysis, interconnection and tariffing as well as engineering and technical capabilities (Marcelle, 2004: 151). This suggests that while consultants enable regulators to meet an immediate need, policymakers need to address the long-term skill gaps.

To achieve this, interviewees suggested the need for training and reskilling regulatory personnel (as relevant skills will change over time) as well as having a transparent recruitment process as indicated in Figure 20. On training and reskilling issues, countries across Africa have the opportunity to do this through the various workshops offered by the Commonwealth Telecommunications Organisation (CTO)[158]. For example, countries such as Cameroon, Ghana, Nigeria, South Africa and Uganda were present at the Preparatory Meeting held in October 2015 at the CTO headquarters in London (CTO, 2015). This workshop provided the platform for member states and private players to brainstorm issues relating to spectrum allocation, identification of additional frequency bands for International Mobile

[158] CTO is a multilateral body that supports member states with consultancy, training and capacity development for the advancement of ICT via conferences and workshops (Commonwealth, 2017; CTO, 2017).

Telecommunications and resolution on the agenda for the World Radiocommunication Conference (WRC) held in Geneva later on in the same year.

The ITU also organises various sections, including the Global Symposium for Regulators, which is held between June and July annually (ITU, 2017d). This gathering provides regulators and other key stakeholders with the platform to exchange learned-experience on how to deal with emerging digital transformation issues, including new technologies. Tanzania also trains and reskill its regulatory personnel through bilateral and international cooperation with, for example, the US Telecommunication Training Institute and the UK Department of Trade and Industry (Marcelle, 2004: 146). Whilst these countries are taking advantage of these opportunities, one may argue that since most of these events take place across the world, attendance and participation comes at a cost. This further raises the issue of how much funding is available to a regulator to execute its functions and attend such vital events.

The issue of having a transparent recruitment process was borne out of the concern raised by interviewees that undue political interference can result in the appointment and/or recruitment of regulatory personnel with the implication of placing people with the wrong skill sets in the position of authority (Section 5.2.8). Consequently, vacant positions within regulatory authority may be filled along the lines of political interest instead of allowing a competitive and transparent process that would most likely result in the selection of persons with relevant skills. This links back to the issue of political capture that was raised in Sections 3.2.2 and 8.2.1. South Africa is a classic case where a lack of competency in ICASA is demonstrated through poor leadership and political interference. This is underlined by the frequent clashes between the sector minister, for example, Ms. Faith Muthambi and Mr. Lumko Mtimde versus a series of councillors at ICASA and USAASA board members on issues bordering on improper conducts, appointments and dismissals (Gedye, 2016; Mcleod, 2018; Steyn, 2014)

The comments of interviewees suggested that in countries where this happens, politics would be allowed to take over a critical and technical sector such as telecommunications where experts ought to be running the affairs. They asserted that a transparent recruitment process will more likely lead to the appointment of high calibre personnel with the relevant skills to provide technical capacity and knowhow

to plan and deploy USF as shown in Figure 20. Interviewees concluded that such personnel will also put a transparent system in place that facilitates wider stakeholder engagement and help regulators to draw on the ideas and synergy of the industry and, ultimately, mitigate the complexity of UAS.

8.2.4 Summary

From the analysis present so far in this section, one cannot overlook the importance of having a well-resourced regulator. Figure 19 indicated that this would lead to better regulation and help policymakers to achieve more in terms of increasing widespread access to telecommunications. For example, 13 interviewees recognised that affordability is one of the major impediments to the adoption and diffusion of mobile telephony in Africa. This is particularly evident in the high cost of data in various countries as highlighted in Table 10 (Section 5.3.4.1). To achieve widespread mobile adoption, the problem of affordability needs to be addressed in light of the fact that this is one of the five underlying principles for achieving UAS as explained in Section 3.3.1. This affordability problem has caught the attention of countries such as Kenya, South Africa, Uganda and Zimbabwe where the regulators have launched an investigation to assess the level of 'fair' and 'competitive' tariffs (Englebrecht, 2017).

The analysis presented so far suggests that such an investigation can only yield the desired outcome if the regulators are staffed with personnel with the relevant skill sets. They will then be able to calculate costs correctly and then use such information to begin to challenge and engage with MNO on how to promote affordability. Interviewees suggested that such a regulator can better engage stakeholders and look for innovative ways to tackle affordability and help promote mobile adoption through, for example, the provision of subsidised (smart) mobile phones. In addition to this, the analysis of market failure in Section 3.2.1 showed market actors like MNO are often well-resourced and have people with better skills who can capture and confuse regulators. The analysis in this chapter counters that a better-paid regulator with adequate funding would be less likely influenced by powerful MNE MNO.

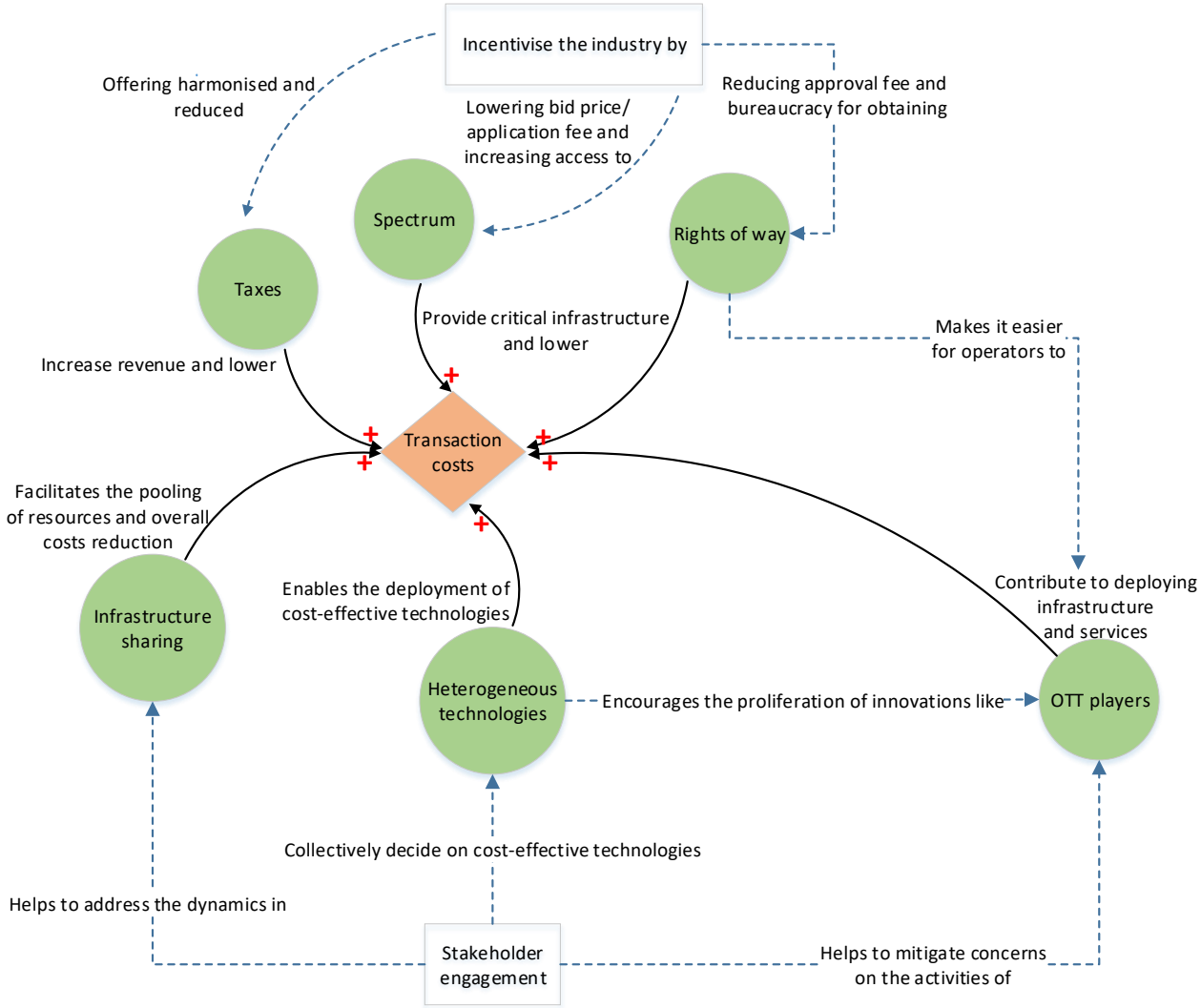
To this end, it is apparent that regulatory capacity is a fundamental underpinning issue when it comes to addressing market failure, particularly from the viewpoint of promoting equitable access to telecommunications as indicates in Figure 20. Therefore, a regulator can only be as competent as its capacity permits. Whilst the

argument in this section is not trying to oversimplify the complexity of the problems associated with digital divide in Africa, the evidence presented suggests that regulatory capacity is an intractable long-term problem that needs to be sorted out. Having said that, it also worth re-emphasising that while the improvement of regulatory capacity is necessary for increasing mobile coverage, it is not sufficient. The reason being that while a well-resourced regulator is better positioned to perform its duties and resist the influence of rent-seeking interests in the market, they also need to be disentangled from political capture. Addressing one without the other will undermine the regulators and stifle their ability to address the market failure of uneven mobile coverage.

8.3 Transaction costs

While the discussion in Section 8.2 was largely anchored on the public interest perspective of market failure, the economic efficiency perspective will guide the discussion in this section (Dollery, 1999; Economides, 2004; Wenders, 1988; Wolf, 1987). This is in light of the positioning of this thesis that, to correct market failure in a liberalised telecommunications sector as applicable across Africa, policymakers and other key players in the industry need to address both public interest and economic efficiency perspectives (Section 3.2). While the public interest perspective facilitates equitable/widespread access to telecommunications, economic efficiency promotes the commercial viability of network deployment and maintenance in order to attract investment and encourage operators to increase coverage as depicted in Figure 19. Contrary to the complexity of the model in Figure 19, Figure 21 provides a focused version from an economic efficiency perspective.

Figure 21: Addressing market failure from an economic efficiency perspective



Of the seven causes of market failure examined in Section 3.2.1, evidence from Section 5.3 indicates that transaction costs are the most fundamental factor that limits the economic efficiency of coverage expansion. Section 5.3 further highlighted that since the investment decision of MNO is typically influenced by the cost-benefit analysis of network deployment, MNO would naturally gravitate towards areas that have greater net (economic) benefit. Hence, prohibitive[159] transaction costs can discourage MNO from investing beyond commercially viable areas, which then leads to market failure (Arndt, 1988; Gabel, 2007; Zerbe & McCurdy, 1999). The impact of transaction costs on the digital divide in Africa has also been acknowledged by the World Bank who has been working with policymakers to reduce the costs of deploying telecommunications across Africa. This includes a $70 million grant for Burkina Faso to support coverage expansion, including electricity and road construction in 2018 and $19.4 million to the West Africa Regional Communications Infrastructure Project in 2011 to lower transaction costs and improve connectivity between countries like Burkina Faso and Ghana (World Bank, 2018a; 2018b).

Therefore, evidence from the empirical data is consistent with the submission that since high transaction costs could result in market inefficiency, transaction costs are the root cause of market failure (Todorova, 2016; Williamson, 1968; 1972; 1985). When transaction costs become prohibitive and result in market failure, governments should intervene not only to guarantee equity, but to also promote competition (Todorova, 2016; Rob, Tausha, & Vilakazi; 2017). To this end, interviewees made various recommendations that can help to address the fundamental issue of reducing transaction costs and encourage the market to invest in coverage expansion as presented in Chapters 6 and 7. Figure 21 highlights the key issues within these recommendations. They include indirect market intervention via various incentives such as taxation, frequency spectrum and rights of way. In addition to this are collaboration and innovation through infrastructure sharing and the deployment of heterogeneous technologies.

[159] This is a situation where the costs of network deployment outweigh the benefit derived, which can be variable depending on the circumstances and the political environment in a given country.

8.3.1 Incentives

From the four recommendations presented in Section 6.3 on indirect market interventions, ten interviewees commented on the need for policymakers to provide MNO with various incentives such as tax breaks, affordable and timely access to (low) frequency spectrum and rights of way to help lower transaction costs as illustrated in Figure 21. The underlining argument here is that the cost savings that may result from the process would not only enable MNO to investment in coverage expansion but also offer lower tariffs and affordable mobile devices. This is significant in light of the fact that increase in costs is more or less transferred to end-users, which will further exacerbate the affordability problem.

While such an argument is supported by Bergman et al. (1998), who stated that policymakers could correct market failure by targeting widespread access to telecommunications through various incentives, the use of such regulatory instrument is not without its limitations as examined in Section 3.2.2. For example, the use of incentives can result in a free rider problem[160] and since it is less coercive compared to the use of mandates, market actors can take up incentives without complying with its conditions (Gillingham & Sweeney, 2010; Grabosky, 1995). Furthermore, although cost savings may arise from enjoying incentives, as proposed by interviewees, there appears to be no guarantee that beneficiary market actors would then go ahead and invest such savings in coverage expansion. In other words, the cost savings that may accrue to market actors could be diverted to other uses that are not beneficial to the public (Adams, 2000). This can be illustrated by a recent report that market actors like the New Dawn Satellite and Intelsat have channelled a substantial amount of their tax savings from countries like South Africa and Tanzania to Mauritius – one of the continent's tax havens (Fitzgibbon, 2018). Specifically, it is projected that, through this tax arrangement, the New Dawn Satellite would pay only 0.03% of tax - around $22,000 on $75 million revenue while Intelsat paid only 0.09% on its $31 million revenue in 2013 (Fitzgibbon, 2018). Although these satellite operators entered the market to 'promote African development' by helping to extend coverage, their tax strategy appears to negate this argument.

[160] A situation where operators enjoy incentives without reflecting it in their operations and project execution (Section 3.2.2).

These limitations reinforce the need for monitoring and compliance without which the use of incentives will be susceptible to subversion and unscrupulous actions by market actors (Grabosky, 1995). This can then detract the goal of bringing connectivity to the unconnected. Thus, for the use of incentive be effective and efficient, regulators need to enforce compliance to ensure that beneficiaries are held accountable and provide what they ought to for enjoying such benefit. For example, following the negotiation of import duty reduction and VAT elimination on mobile devices in Ghana, the country's Chamber of Telecommunications asserted that MNO and importers of mobile devices should ensure that such incentives reflect in their tariffs going forward (Adepoju, 2016a). Consequently, as with other regulatory instruments explored in Section 3.2.2, the successful deployment of incentive adds to the costs of monitoring and compliance and, by extension, reinforces the debate on regulatory capacity.

8.3.1.1 Taxation

Various studies (for example, Cave & Mfuh, 2013; Deloitte & GSMA, 2011; Desai, Foley, & Hines, 2014; Wentrup et al., 2016) have highlighted that it is not uncommon for market actors like MNO to complain about taxes. However, evidence from Sections 5.3.3 and 6.3.3 helps to underline the fact that tax rate for telecommunications varies across Africa with the existence of multiple taxations in some countries. For example, aside from the standard corporate tax, various sector-specific taxes, including SIM card tax, mobile money transaction, customs duties on handset/telecommunications equipment and VAT on voice and data services, are applicable across Africa. In addition to the evidence presented in Table 9 in Section 5.3.3, the government of South Sudan has announced plans to increase the tax on telecommunication services from 10% to 30% in order to plug a hole in the $300 million budget for 2017/2018 (TeleGeography, 2017g). Tunisia is introducing 20% customs duties on ICT devices like smartphones and computers from January 2018 and Nigeria has proposed a 9% communication tax (Adepoju, 2016b). MNO in Nigeria have voiced their unease arguing that they were already subjected to multiple taxations and levies, and that this would have a negatively impact on end-users who are already spending between 7-18% of their monthly income on telecommunication services (Adepoju, 2016b; 2016c). This is in stark contrast to the 5% affordability target

recommended by the UN as well as the 2% suggested by Alliance for Affordable Internet – which has now been adopted by the UN (A4AI, 2017b; ITU, 2013a).

Section 2.3 highlighted that FDI flows were instrumental to the transformation of the telecommunications sector and the development of a burgeoning ICT ecosystem. Governments across Africa see the sector as a 'cash-cow' as MNO who attracted these FDI are becoming major contributors to national budgets, accounting for 5% to 15% of income tax in the continent (Xalam Analytics, 2018). While it is well within the right of governments to collect these taxes for the development of the overall economy, similar to Table 9, studies (for example, Frontier Economis & GSMA, 2008; World Economic Forum, 2014; Shenglin et al., 2017) also found that excessive taxes on the telecommunication sector in countries like Ghana, Nigeria, Kenya and Tanzania impinge on the ability of operators to close the digital divide. The impact of such taxes is significant considering recent drop in ARPU to an average of 3% to 6% from double digits in 2014 coupled with the costs of network deployment, which is exacerbated by the lack of supporting infrastructure like electricity (ATU & Huawei, 2018; Xalam Analytics, 2018). This trend will lead operators to concentrate in commercially viable areas and result in the failure of the market in addressing the telecommunications needs of the wider society (Arndt, 1988; Gabel, 2007; Zerbe & McCurdy, 1999).

Hence, interviewees asserted that the implication of imposing multiple taxes on a sector that is already capital intensive and critical like telecommunications can have far-reaching consequences. For example, the practice of imposing customs duties on telecommunications equipment[161] can endanger investment in coverage expansion to disadvantaged areas owing to prohibitive transaction costs for MNO and equipment vendors. Taxes on handsets[162] can also discourage mobile adoption due to a shift in the incidence of tax on mobile phones to end-users. This further worsens the affordability problem inherent in the industry as highlighted in Section 5.3.4.

Therefore, evidence from the aforementioned literature and comments from interviewees suggest that multiple taxations on the telecommunications sector can be

[161] For example, 14.2% is applicable in Benin Republic (WTO, n.d., p. 29).

[162] For example, 5% and 15% VAT is applicable in Angola and Egypt, respectively (see Table 11 in Section 5.3.3).

counterproductive. As this will increase the transaction costs of network deployment and maintenance, which will then restrict further investment in the sector. Since cost is interlinked with tariff, such a practice can also limit mobile penetration and adoption for end-users. The wider effect of this will mean an increasing lack of economic feasibility for the market to push coverage beyond big cities and towns.

To mitigate/prevent market failure in this case, Section 3.2.2 suggested that government can offer tax breaks to encourage more investment (Chen, 2015; Mitchell, 1995; Oman, 2000). This is consistent with the views of interviewees who recommended that government could incentivise the industry with a favourable tax regime in terms of reducing rates and eliminating multiple taxations through a harmonised[163] system as shown in Figure 21. Evidence from the country analysis indicates that some countries are beginning to acknowledge that multiple taxes are an impediment to the expansion of coverage. For example, the NCC has identified multiple taxation as one of the hindrances to the development of the telecommunications sector in the country as several government agencies threaten to shut down BTS belonging to MNO for their refusal to pay state and local government taxes in addition to the ones being paid at the federal level (Adepoju, 2016c). NCC admitted that this would put more pressure on an already 'overburdened' industry, which can discourage further investment in the sector (Goodie, 2017). The NCC is now advocating for a harmonised system of taxation to reduce the costs burden on the industry (Adepoju, 2016c; Goodie, 2017). This is also evident in South Africa, where the treasury has announced a series of incentives for the telecommunications sector in 2018 budget, including the harmonisation of its tax system to encourage more investment in the expansion of fibre optic (BusinessTech, 2018a; National Treasury RSA, 2018). This is supported by Afadhali (2016) who argues that the 'good' practice of taxation should support a harmonised and broad-based approach where various levels of government cooperate to reduce the burden on the telecommunications industry in Africa.

Governments need taxes to generate revenue, but in a continent like Africa where the proportion of tax to GDP generally averages around 17% compared to 35%

[163] Harmonisation involves an integration of the tax rates by various levels of government within a country in order to ensure that the industry is taxed at a single rate contrary to multiple rates (World Economic Forum, 2014).

among OECD countries, governments tend to tax the telecommunications industry more (Cave & Mfuh, 2013; Economist, 2017). For example, between 2016 and 2017, income tax from the sector averaged about $350 million, which is ten times the annual average before 2015 (Xalam Analytics, 2018). Curwen and Whalley (2018) state that the revenue that accrues to government from such tax is critical for the wider economy. However, overburdening the sector with multiple taxes can be a 'short-sighted' strategy as studies have shown that in the long-run, increase adoption is likely to contribute more to the economy (Deloitte & GSMA, 2011; Hudson, 2006). For instance, an increase in taxes levied on handsets may result in limited sales in the official market relative to the informal market where taxes are not applicable. Therefore, limiting and/or abolishing sales tax on mobile devices may discourage the spread of the informal market and encourage sales in the official market where it is more cost-effective for the government to collect taxes (Cave & Mfuh, 2013).

While this reinforces the importance of the affordability principle of UAS (Section 3.3.1), it also underlines that the socio-economic benefits of affordable access to telecommunications are more likely to surpass the rather short-term gratification of charging multiple taxes (Afadhali, 2016). This can be illustrated with the case of Kenya where the abolition of VAT on mobile handsets in 2009 led to a 200% rise in handsets sales and 20% more in mobile penetration over three years (Deloitte & GSMA, 2011). Similarly, policymakers in Ghana lowered import duties from 20% to 10% and eliminated VAT on mobile phones in 2016 to promote affordable access to telecommunications (Adepoju, 2016a). Drawing on Section 3.2.2, for tax reductions to be impactful on closing the digital divide, regulators need to monitor the activities of beneficiaries like MNO and handset vendors to ensure that prices are reduced to reflect such incentive.

8.3.1.2 Spectrum

Another area suggested by interviewees through which policymakers can incentivise MNO to close the digital divide is through a spectrum policy that encourages investment. Section 5.3.2 highlighted that spectrum administration in various African countries is acting as an impediment to widespread access to telecommunications in terms of insufficient allocation and bidding prices. Interviewees asserted that such practice restricts the capacity of MNO and other smaller players to extend their footprint as high bidding prices feed into the transaction costs of coverage expansion.

Of particular interest from Section 5.3.2 is the availability of affordable low-frequency spectrum, especially those within 700MHz-900MHz range (Bell, 2016; ITU, 2010). Majority of this frequency band can be found in TVWS – "…*the portions of spectrum left unused by broadcasting*… as promoted by the ITU (Doeven, et al., 2012, p. 41; ITU, 2010). Since 2007 when TVWS was first identified at the WRC-07, it has become a hotly debated issue by stakeholders in the industry (GSMA, 2012a; ITU, 2010). Part of the reason for this is that although the reserve of spectrum in such frequency bands is vital to the proliferation of coverage due to the efficiency it offers for wider reception and better indoor penetration than higher band, TV broadcasters currently occupy these bands (Bell, 2016; Doeven, et al., 2012; ITU, 2010). Hence the need for digital migration to relocate TV broadcasters to the 470MHz-694MHz band, switching broadcasting from analogue to digital transmission and freeing up more spectrum in the 700MHz-900MHz range to facilitate digital inclusion (Bell, 2016; Borth, et al., 2008).

That being said, there are some concerns regarding the use of TVWS. These concerns include the difficulty associated with identification and monitoring of the relevant frequency bands and the technical capacity to manage the process to avoid interference between users (Borth, et al., 2008; Markendahl & Makitalo, 2011; Ofcom, 2015). The emergence of such technology also has a wider implication for operators and policymakers in terms of establishing new business models and regulation as well as ensuring cooperation among existing and new stakeholders (Markendahl & Mäkitalo, 2011). Although interviewees stressed more on affordable and timely access to (low) frequency spectrum, the above concerns raised in the literature also appear to be as critical. Therefore, policymakers and operators need to consider these issues if the use of TVWS is to gain traction in helping to tackle the digital divide in Africa.

To connect the unconnected, countries with large rural communities need to accelerate the release of low-frequency spectrum (Cui et al., 2017; GSMA, 2016a). According to the senior director and head of government affairs at Qualcomm Africa – Elizabeth Migwalla – although Africa is the most unconnected part in the world, it also has the most identified spectrum to drive connectivity to disadvantaged areas with 700 and 800MHz band (Gilbert, 2016b). If this is the case, it then raises the question as to why such band of spectrum is not being released or accessed by MNO and smaller providers.

Evidence from Section 5.3.2 suggests that this is due to high bidding prices, delays and an insufficient allocation by policymakers, which combines to create scarcity. Popoola et al. (2016) have documented a similar observation in the case of Nigeria where they found that the current spectrum allocation policy is creating scarcity and under-utilisation of spectrum frequency. Section 5.3.2 also highlighted the case of South Africa where there is a delay in the allocation of low-frequency spectrum because of an impasse between the sector ministry and the regulator over the mode of allocation. According to South Africa's Minister of Finance, Malusi Gigaba, such a delay is *"…costing the industry and affecting much-needed growth, not only in ICT but also other sectors that are impacted by ICT*" (Mzekandaba, 2017c). Furthermore, over 30 countries in Africa, including Nigeria, with the exception of a few such as Kenya, have failed to meet two Digital Switch-Over deadlines set by the ITU - June 7, 2012, and 2015 (Adepetun, 2017; El-Moghazi, Whalley, & Irvine, 2017). This further underlines the administrative difficulties facing the availability and release of low-frequency spectrum in Africa.

Although some big players in the industry like MTN (as will be seen later on in this section) pay the bid price for spectrum, Section 5.3.2 highlights that such bidding price can also be prohibitive - particularly in relation to the market conditions such as the availability of supporting infrastructure, the share of subscribers and financial capacity of smaller operators. This can be explained with the case of South Africa where ICASA is asking for R3 billion[164] as the minimum auction price to issue a 15-year licence for 600MHz, 700MHz and 800MHz spectrum bands (van Zyl, 2016). This does not include the non-refundable application fee of R3 million[165], which all applicants must pay to participate in the bidding process (van Zyl, 2016). MNO in the country, particularly a small player like Cell C, have expressed concerns about the reserve price and the limited one-month period for which the offer is opened. This suggests that the bidding price and other conditions attached to the offer from ICASA did not reflect the capacity of all MNO to participate in the process. It is not just the interviewees in this study that have argued that bidding price of spectrum can become prohibitive and endanger the proliferation of coverage, evidence from Kuroda and

[164] About $216 million

[165] About $215,000

Forero (2017) also supports this view. They argued that when the sale of spectrum is used as a vehicle for raising 'public revenues', the governments may get the income they want but this will also impact negatively on the wider industry.

In formulating such market decision, interviewees asserted that policymakers need to ensure that such decision reflects the ability of all MNO to realise their economic objective. This is critical in the sense that without the participation of market actors like MNO, policymakers cannot realise the public interest objective of improving digital inclusion (Section 3.2). Anker (2017: 4) further added that "*If as a result of considerations of profitability firms decide not to use the system as intended, the government fails in realising its objectives.*" This is consistent with the key message of the model in Figure 19 - that UAS policy should be formulated in a manner that captures the public interest objective of widespread access and somewhat promotes the economic efficiency of network deployment to mitigate the market failure of even mobile coverage. To achieve this, interviewees suggested that when policymakers are fixing spectrum prices, they should factor in national conditions like infrastructure deficits - for example, the lack of electricity. Such deficit adds substantially to the transaction costs of MNO and impacts the amount of investment required to deploy network and services in a sustainable manner.

Figure 21 indicates that lowering the bid price/application fee for spectrum, especially for operators willing to serve disadvantaged areas, can be a viable incentive for the market to lower their transaction costs. More significantly, since low-frequency spectrum has been proven to facilitate the digitisation of disadvantaged areas (Bell, 2016; Borth, et al., 2008), there is the need for policymakers to promote cheaper and quick access to such frequency bands. Interviewees argued that this would help to lower transaction costs and incentivise big and small players to provide widespread coverage in a cost-effective manner. This would also encourage the proliferation of LCE like Zenzeleni Networks that is helping to close the digital divide in the remote Mankosi community in Eastern Cape Province of South Africa (Section 7.3.2). This has attracted the attention of the Deputy Minister of Telecommunications - Stella Ndabeni-Abrahams – who has pledged to collaborate with Zenzeleni to bring affordable connectivity to more people in Eastern Cape Province (APC, 2018). Ghana also appears to be offering similar support, albeit to MNO following the move by NCA to grant MNO with existing 2G licence the permission to deploy 3G using the 900MHz

band free of charge for disadvantaged areas (NCA, 2017; Ogundeji, 2017). This also includes the waiver of application and 'authorisation' fees with the intention of incentivising MNO to expand their mobile footprint with 'minimum' costs (NCA, 2017).

Although the action of Ghana appears to be consistent with the recommendation of interviewees, NCA needs to ensure that any MNO that gets this incentive is actually expanding 3G coverage in disadvantaged areas and not diverting it to commercially viable places. Such an enforcement does not only require technical and financial capacities, it also requires information such as the location of under-and-unserved areas and their relevant telecommunication needs. Considering the private sector generally has access to market information than the public sector, information asymmetry[166] could also be a challenge (Section 3.2.1). This underlines the fact that apart from transaction costs, an unequal availability of information to everyone in the market can also lead to market failure (Dassler, 2006; Gomez-Barroso & Perez-Martinez, 2005; Weimer & Vining, 2010). Figure **Error! Reference source not found.** indicates that this and other complexities could be mitigated by stakeholder engagement, particularly by engaging with and involving local communities. Information generated from this process can prove vital in unraveling the actual state of affairs in a given community instead of deploying funds 'blindly' (Section 6.2.2).

8.3.1.3 Rights of way

The last incentive that can help to economise the transaction costs of coverage expansion, as suggested by interviewees, is to help MNO secure affordable and quick access to rights of way. Section 5.3.1 has established the critical role of rights of way in infrastructure deployment. For example, without a piece of land, MNO and Infraco cannot construct BTS or deploy cables, without passage right, they cannot deploy undersea fibre optics. Without this critical infrastructure, services cannot be transmitted to end-users. Despite the unassailable role played by rights of way, Section 5.3.1 shows that operators encounter various difficulties when it comes to securing such rights, especially in terms of administrative bureaucracies and fees. Interviewees contended that these difficulties are more significant in areas where the state, local

[166] See Section 3.2.1 for explanation.

governments and host communities, demand different fees from operators before allowing them access to land for constructing physical infrastructure as illustrated with the case of Nigeria in Section 5.3.3.

Interviewees more or less agreed that this is one area where policymakers can indirectly intervene to encourage operators to expand into areas lacking coverage (Section 6.3.3). Evidence from the country analysis illustrates that some countries have started the implementation of this recommendation. For example, the NCC has echoed a similar sentiment that one of the challenges facing MNO in Nigeria is the demands placed to the issuance of rights of way by state and local governments across the country (Adepoju, 2016c). Consequently, the Executive Vice-Chairman of the NCC, Professor Umar Danbatta, used his influence to secure a 'permit fee' waiver of N221 million[167] for MTN Nigeria (Adepetun, 2017; ITNews Africa, 2017). The waiver was to facilitate the rights of passage for the deployment of fibre infrastructure in Kano, one of the northern states in Nigeria. GIFEC is also helping MTN and Ericson to secure rights of way for the construction of 40 BTS in Ghana as part of a $12 million Rural Telephony Project (Adepoju, 2017a).

Apart from the actions of NCC and GIFEC, interviewees suggested that policymakers could further accelerate the process of obtaining rights of way through the provision of a clear and rapid application procedure to eliminate unnecessary bureaucracies. For example, Interviewee18[168] revealed the sector regulator in Tanzania is currently working on refining the process of issuing rights of way by engaging with the Ministry of Environment to reduce the turnaround time of issuing approvals. This comes on the heels of MNO complaining that access to rights of way is the *"major"* reason that hinders them from executing USF projects even after the funds have been released to them.

8.3.1.4 Summary

The analysis in this section suggests that the use of incentives such as tax breaks, affordable and timely access to (low) frequency spectrum and rights of way is a promising regulatory instrument for correcting market failure linked to transaction

[167] About $700, 000.

[168] A regulatory specialist with an international lending organisation who is working with countries in Eastern Africa to improve coverage.

costs. This is significant in light of the fact that in a capital-intensive sector such as telecommunications, prohibitive costs of network deployment and maintenance can deter MNO from extending mobile coverage beyond commercially viable areas, thus enabling digital divide to persist (Arndt, 1988; Gabel, 2007; Zerbe & McCurdy, 1999). Figure 21 indicates that the deployment of incentives can help to lower transaction costs, promote the economic efficiency of network deployment and encourage MNO to increase coverage. Apart from improving the economic feasibility of network deployment, offering incentives like the elimination of VAT on smartphones can help to improve affordability for end-users, which is one of the fundamental principles of achieving UAS (Section 3.3.1). Furthermore, reducing or eliminating the tax on mobile money transaction can help to improve digital financial inclusion in light of the fact that two-thirds of the over 1 billion people in Africa do not have access to traditional financial services (World Bank, 2015 & 2017).

While the use of incentives offers promising benefits to the industry, it comes at a cost to the governments who rely on the taxes and (spectrum) licence fees from the sector to fund their national budgets (Curwen & Whalley, 2018; Xalam Analytics, 2018). Curwen and Whalley (2018) thus argue that governments may be unwilling to give tax incentives. This was echoed by Interviewee26[169] who stated that… *with a multitude of needs competing for limited budget, which is mainly funded by taxes, the implementation of tax incentives may be very difficult…* While this raises the question of who pays for such incentives, governments also need to consider the wider implication of the digital divide that would persist if MNO keep concentrating on commercially viable areas while over half of the continent's population residing across disadvantaged areas are left behind (World Bank, 2015).

Section 3.2.1 highlighted that telecommunications is a mixed good that can facilitate positive externality in terms of a wider socio-economic benefit such as education, banking, health, jobs and governance. This was also highlighted in a recent meeting of the Broadband Commission for Sustainable Development where industry leaders from different backgrounds, including heads of states like Paul Kagame[170], argued that such socio-economic benefit are even more significant for people living in

[169] A senior employee within one of the Ministry of Transport and Communications in Africa

[170] Paul Kagame is the President of Rwanda

deprived areas (ITU, 2018). To this end, UAS to telecommunications should be seen as an indispensable tool that drives the functioning of modern society without which there would be a severe level of social disparity and lack of opportunities (Batura, 2017; Haftu, 2018; Shenglin et al., 2017; Souter, 2018b; Szeles, 2018). World Bank (2016) called this effect the'digital impact divide'. As such, even if it may cost the governments to support UAS through incentives in the short-term, the long-term benefit and wider impact of closing the digital divide of uneven mobile coverage appears to be greater (Ali, 2016; Bergman et al., 1998; Gomez-Barroso & Perez-Martinez, 2005; Levine & Taylor, 2018). Moreover, governments cannot promote widespread access to telecommunications without building a business environment that encourages competition (which was critical to the transformation of the sector in Africa as indicated in Chapter 2), as this could result to the excessive concentration of market actors in economically viable areas (Dasgupta, Lall, & Wheeler, 2001; Shenglin et al., 2017).

Aside from the cost debate, it is worth emphasising that the use of incentives has its shortcomings. Section 3.2.2 has dealt with this in detail, one of which is a free rider problem – a situation where benefiting market actors may take an incentive and fail to reflect this in their business model. For example, failing to plough-back the resulting cost-savings into coverage expansion in disadvantaged areas, offering affordable mobile tariffs as a result of receiving tax breaks and low-frequency spectrum free of charge or at a reduced rate. This raises the issue of monitoring and enforcement, the efficacy of which is partly dependent on reliable information (Section 3.2.1) and the level of resources available to a regulator (Section 8.2).

8.3.2 Infrastructure sharing as a make or buy decision

Section 7.2 recounted various means of collaboration, which relevant stakeholders can employ to improve coverage expansion. From the four issues presented in Section 7.2, infrastructure sharing was particularly significant in light of the fact that it drew comments from 24 interviewees. The concept of infrastructure sharing can be explained by the transaction cost theory, which states that a firm will internalise certain business operations, especially those that it can execute at a lower cost, and outsource other operations that an external party can execute with a cost advantage (Anderson & Gatignon, 1999; Brouthers & Brouthers, 2003; Pan & Tse, 2000; Williamson, 1986; 1979). The phenomenon of outsourcing the management and operation of

telecommunications network to an Infraco and then enter into a sharing arrangement with rivals is akin to a make or buy decision (Sako, Chondrakis, & Vaaller, 2016). Although make or buy decisions have been historically linked with manufacturing firms (Jauch & Wilson, 1979), the emergence of infrastructure sharing suggests it has extended to telecommunications. The need to reduce costs and improve returns in order to remain competitive has ignited the debate of whether to keep certain business operation in-house or to outsource them (Schwarting & Weissbarth, 2011). The possibility of lowering the transaction costs of business operation appears to be a critical factor when it comes to such decision (Li, Lee, & Walker, 2015; Sako, Chondrakis, & Vaaller, 2016; Schwarting & Weissbarth, 2011).

As indicated in Figure 21, interviewees broadly agreed that infrastructure sharing could result in the pooling of resources and a reduction in the overall costs of network deployment and maintenance, particularly through co-location of servers, sharing BTS and generator sets. However, , there was a lack of consensus on whether infrastructure sharing among MNO would translate into the improvement of coverage in disadvantaged areas. Section 7.2.1 highlighted that while interviewees agreed that more costs-savings can accrue to MNO from sharing infrastructure with rivals, opinions were split on the idea that MNO would then reinvest such money in areas lacking coverage, thereby shifting the burden to other parties who do so. The literature refers to this as the 'transfer of risk' to others within a sharing agreement (Bing et al., 2005; IMF, 2004; Kargol & Sokol, 2008). One of the ways of dealing with the issue of risk shifting is through public disclosure so that stakeholders such as civil society can then use such information to demand accountability from the various parties involved in infrastructure sharing (IMF, 2004). This helps to justify why stakeholder engagement has been linked to infrastructure sharing in Figure 21.

Secondly, interviewees in Section 7.2.1 also argued that while infrastructure sharing can prevent duplication of resources and protect the environment from the impact of multiple BTS located close to each other, it does not on its own provide a mechanism to change the prevailing circumstances of non-commercially viable areas. For example, the vast majority of the circa '22 million' under-and-unserved people in South Africa live in non-commercially viable areas and mostly like cannot afford smartphones and data tariff (Zollner, 2017). In such case, infrastructure sharing cannot

address the missing market[171] that results from the lack of smartphone affordability due to low-income levels, neither can it address the incomplete market[172] that arises from low demand that stems from the spare population density associated with some disadvantaged locations.

Under such circumstances, Section 3.2.1 makes a case for natural monopoly arguing that for a country that has geographical challenges such as large distances and isolated areas, a limited competition that guarantees increasing returns to scale may better serve such market. As such, Interviewees18[173] and 21[174] suggested that allocating such areas among big and small players, and then issuing them with a non-competing licence to be the sole provider for their allotted locations might be more interesting than infrastructure sharing (Section 6.3.2). The reason behind such argument is that if operators are permitted to serve such areas without competition and keep improving things over time, returns may gradually surpass the costs of deployment and allow for business sustainability even without USF intervention.

South Africa has attempted a similar strategy through its under-serviced area licencing initiative (Gillwald, 2002; 2005a). Section 6.3.2 highlighted that its implementation has been hampered by delays in licence issuance and a lack of political will to release funding for the operators as stipulated in the licence conditions. Interviewee26[175] revealed that Zambia also began issuing underserviced area licence to MNO in mid-2017 to help achieve UAS. Since its implementation is still underway, it remains to be seen how successful it would be. However, interviewees stressed that to forestall abuse in the issuance of such a licence, the process should follow a transparent and open auction system that permits equal participation by all players in the market. It was further suggested that policymakers could also allocate areas based on the capacity of operators, allow them to decide which disadvantaged locations they want to serve and/or offer such licence free to small players to encourage their participation.

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[171] See Section 3.2.1

[172] See Section 3.2.1

[173] A regulatory specialist for an international lender who funds rural telecommunications in Africa

[174] A former director of public policy for a multinational MNO

[175] A senior employee within the Ministry of Transport and Communications

The third issue that led to the split of opinions on infrastructure sharing is that the first MNO that extend its footprint into a location typically enjoys the first-mover advantage by getting most of the customers and keep them through low On-Net tariffs. Such a suggestion by the interviewees is consistent with the studies (Armstrong, 1998; Hawthrone, 2018), which found that a network operator could use 'high' mobile termination rate (MTR)[176] to leverage and increase its market position. Interviewees then argued that if late arrivals have the opportunity to enter a disadvantaged location by sharing existing local infrastructure, they might not be interested as the majority of the customers may have been captured. The comment from Interviewee12[177], corroborated by Interviewee9[178], highlighted this lack of interest from MNO. It was gathered from Interviewee9 that NCC built towers in selected unserved villages and asked MNO to come and put their equipment. MNO did not go there as they argued that there was no business case to invest in such locations. This is somewhat paradoxical considering that NCC (2017) projects that Nigeria needs around 80,000 BTS, compared to the current 50,000 in operation (Adepoju, 2017c), to meet the growing demand for telecommunications, yet there are some BTS lying idle. Figure 21 indicates that Nigeria, and other countries in Africa, can avoid such resource wastage through wider stakeholder consultation as this can help to address the concerns and dynamics inherent in infrastructure sharing.

To address the lack of interest from MNO, interviewees further suggested that policymakers should consider mandating the elimination of MTR between operators for serving disadvantaged areas. This will not only allow smaller players to interconnect to the networks of the bigger players at little or no cost in serving sparsely populated areas, but also encourage wider participation in infrastructure sharing since late arrivals will be reassured that if they can offer competitive tariff, they can win over some customers from the first-mover. This is particularly significant in light of the fact that MNO with a low subscriber base might not see the need to participate in infrastructure sharing due to the high margins of MTR. This is consistent with the argument in Section 3.2.2 that the regulation of MTR is particularly useful for

[176] MTR is the fee that MNO charge one another to interconnect customers across rival networks (Hawthorne, 2016).

[177] An access specialist

[178] A key regulatory figure in Nigeria

preventing large MNO from charging high access price (Off-Net tariff) that could stymie the expansion and operation of smaller players and limit them from benefiting from network externality.

Furthermore, mandating MTR can contribute to addressing the problem of affordability, which is viewed as one of the major factors limiting mobile adoption and usage across Africa (Section 5.3.4). This is supported by Stork (2012) who found that a reduction in MTR in Botswana, Kenya, Namibia, Nigeria and South Africa led to a decrease in retail prices, lower tariff and increase in mobile adoption. Specifically, a reduction of MTR in Kenya in 2010 led to a fall in retail prices between MNO and allowed smaller players to adopt different pricing strategy to compete with the big players. In the case of Namibia, it led to an expansion in the mobile market, increased investment and ARPU, especially for the big players. Elsewhere in South Africa, Hawthorne (2016) found that the regulation of MTR by ICASA has resulted in a 90% reduction in interconnection charges between 2009 and 2016. The elimination of MTR is also part of the newly commissioned USF programme in Gabon, which is being targeted at over 3,000 unconnected villages with the aim of ensuring maximum coverage and affordability (TeleGeography, 2017b). In addition, MACRA has announced plans to regulate wholesale and retail prices of services in Malawi with the intention of reducing MTR from $4 to $2 per minute following the public concern of high voice tariff (TeleGeography, 2018d). Hawthorne (2018) thus concluded that if policymakers want to encourage the expansion of new entrants and address the margins between On-Net and Off-Net tariffs, they should implement the reduction of MTR.

While the issue of mandating MTR is supported in the literature under price intervention, it is important to note that, as with other mandatory regulatory instruments, price intervention could result in unintended consequences as highlighted in Section 3.2.2. For example, it may result in a lack of cooperation, especially from the big players and, as such, detract the achievement of widespread coverage (Sherman, 1993). Furthermore, although price intervention can be used as a tool for redistributing economic gains to deprived areas and attract smaller players to expand their networks by directing big players to lower interconnection charges, this tool can also be considered as ‘discriminatory’ in a liberalised market (Mitchell, 1995). This can be illustrated with the case of South Africa. When ICASA first proposed to

regulate MTR in 2014, MTN and Vodafone teamed up against the idea in a lawsuit (Lith, 2014). MTN, in particular, argued that the proposal was discriminatory and, at best, a tax on its subscribers to fund smaller players and their users (Bulbulia, 2014). A similar position has been taken by Safaricom, the market leader in Kenya, arguing that the proposal by CA to regulate MTR should be on commercial terms, otherwise, it will only favour players that have not taken the risk to invest in infrastructure (Matinde, 2018b; Miriri, 2018). Mascom Wirless, Botswana's largest MNO, also challenged the decision of BOCRA[179] to cut MTR by 41% but lost the case as the court ruled in favour of the regulator (TeleGeography, 2018c).

Section 7.2.1 further highlighted other dynamics as to why infrastructure sharing has failed to gain traction, especially when it comes to active infrastructure. They include the issue of trust and the fear that sharing core networks may reduce QoS because of shared capacity. It also raises the question of how to calculate and appropriate the costs of network maintenance and upgrade. Zimbabwe is one example of where the market leader, Econet, has refused to share its infrastructure with Telecel and NetOne on the grounds that all MNO have to contribute equally to network maintenance (Mhlanga, 2017). Countries such as Rwanda and South Africa are also trying to promote other forms of sharing such as the single wholesale network to address the shortages of BTS. However, its implementation has also proven to be problematic (Section 7.2.1). Zimbabwe is amongst the latest country to approve such proposition by allocating $250 million from USF for the construction of 600 BTS for the improvement of ‘connectivity in rural areas’ (TeleGeography, 2017i). It is yet to be seen if MNO would use these BTS when the construction is completed as evident in the case of Nigeria.

Generally speaking, the analysis in this section portrays that infrastructure sharing can be a vital tool in tackling market failure that results from high transaction costs. However, there is a lack of consensus on what impact it has on coverage expansion in disadvantaged areas. Furthermore, although this section also highlights the effort of various governments in closing the digital divide in Africa through infrastructure sharing, there no evidence to suggest that such effort reflect the various dynamics presented in this section. Similarly, various studies (for example, Cramton

[179] Botswana Communications Regulatory Authority

& Doyle, 2017; Deloitte & APC, 2015; Ovando, Perez, & Moral, 2015) also support infrastructure sharing without recourse to the aforementioned concerns. This goes to suggest that there is a gap in the debate on infrastructure sharing in Africa and, as such, there is a lack of wider implementation. The analysis in this section indicates that for infrastructure sharing to gain traction and become more popular, issues such as lack of trust, first-mover advantaged, On-and-Off Net tariffs and QoS needs to be critically addressed to have a robust and successful sharing arrangement. This could also help to revolutionise infrastructure sharing and move it beyond the fringes of passive to active sharing of core networks.

8.3.3 Heterogeneous technologies

Section 7.3.1 argued that the deployment of heterogeneous technologies can provide innovative solutions for UAS to flourish in a manner that promotes effectiveness and low-cost access to network deployment. In the sense that solely relying on either 2G[180], 3G[181] or 4G[182] in extending mobile telecommunications might not be an economically viable option in all cases considering that different locations may have different dynamics in terms of population density, topography, telecommunications need and income level. Since the decision of market actors to deploy network is a function of transactions costs and returns on investment, both policymakers and operators need to consider a cheaper and effective way to bring connectivity to disadvantaged areas, which could mean a mix of various mobile technologies.

Typically, mobile technologies are classified with reference to 'generation' such as 2G, 3G, 4G, etc. (Curwen, 2010). A respective generation comes with its unique characteristics such as costs of deployment, capacity, service offering and data transfer speed. The higher the generation, the higher the costs of deployment, service offering and speed, but a lesser generation deployed with CDMA provides greater capacity (Curwen & Whalley, 2010). Furthermore, while lesser generation technology

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[180] 2G stands for second-generation technology, which is used to deploy mobile technology such as global system for mobile (GSM) and code division multiple access (CDMA) (Ahsan et al., 2007; Curwen and Whalley, 2010; 2016).

[181] 3G stands for third-generation technology. This is used to deploy universal mobile telecommunications system (UMTS) (Curwen, 2010; Curwen and Whalley, 2016).

[182] 4G refers to fourth-generation technology, which is used to deploy long-term evolution (LTE) (Clarke, 2014; Curwen and Whalley, 2010).

provides better voice quality and minimal power consumption equipment, higher generation[183] is more suitable for deploying high-speed networks, but at a higher transaction cost in terms of equipment and obtaining new spectrum licence (Ali-Yahiye, 2011; Clarke, 2014; Curwen, 2010; Giaglis, Kourouthanassis, & Tsamakos, 2003; Olla, 2005).

It thus follows from the above that the deployment of various mobile technologies has a wider implication on the proliferation of coverage. For example, since it costs more to deploy higher generation networks that guarantee better data transfer speed and higher audio-visual experience, such network will only make economic sense if there is a higher demand for advanced telecommunication services. In the absence of such demand, MNO may struggle to obtain an ARPU that reflect the transaction costs incurred in installing such network (Olla, 2005). Moreover, end-users need high-end smartphones/devices to access these services, the affordability of which is a problem for low-income earners in Africa (Section 5.3.4.2). The provision of such networks in the absence of high-end smartphones will result in market failure caused by a missing market (Section 3.2.1). In contrast, lower generation networks guarantee more capacity and resilience when it comes to the delivery of basic data, voice, SMS services as well as being relatively cheaper to deploy (Olla, 2005; Curwen & Whalley, 2010). As such, the use of feature phones that mostly operate on 2G (and some on 3G) is still widespread in Africa (GSMA, 2015a; Song, 2017). Lower generation networks thus provide operators with the opportunity of serving a larger part of African population still using feature phones (Reuters, 2017a; Song, 2017; World Bank, 2017).

Following the argument presented above, interviewees voiced their doubts as to whether solely focusing on higher generation networks would be able to deliver cost-effective connectivity to disadvantaged areas. Since different dynamics exist within countries and between regions, Figure 21 suggests that policymakers should talk with stakeholders and collectively decide the 'suitability'[184] of mobile technologies. This raises the question of whether to prioritise speed over widespread coverage, basic data and voice over high-end services such as multimedia, machine-to-machine and the trending internet of things (Olla, 2005; Sudtasan & Mitomo, 2017).

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[183] 3G upwards (Curwen, 2010)

[184] Suitability in terms of costs of deployment, service offering, data speed and capacity.

Section 3.3.4 provides the theoretical argument on whether it is feasible to include advanced services as part of UAS and the need to consider their trade-offs with basic data and voice services.

Interviewees responded to question of trade-offs by asserting that, considering the stage of development of the sector, which is different across Africa, it will be more feasible to first ensure widespread access to coverage over speed and basic services over advanced services. For example, Interviewee25[185] asserted that with the current development of the industry, it appears *"a little bit early"* to be talking about the provision of advanced services 'everywhere'. Interviewee17[186] also shared this sentiment by arguing that it is better for a government to focus effort and scarce resources on increasing coverage, as there is arguably a more social benefit in doing so than focusing on speed. Interviewees concluded that once there is universal coverage of basic voice and data services, then we can start focusing on speed because going from zero to anything is much better.

Although one may argue that this may lead to another form of digital divide in terms of institutionalising limited access to advanced services, James (2007, p. 285) asserted that in developing countries, it may be more effective to focus on "*...closing the one divide rather than the other (if, for instance, the capabilities required for use are less stringent than those demanded by actual production)."* Furthermore, although a lower generation network may not allow users to access advanced services, it does allow for communication and access to online information and services (Lyons, 2017). This indicates that the proliferation of coverage is not all about speed rather, it is also critical to consider other market dynamics when formulating policies and deploying technologies (Stocker & Whalley, 2017). This argument appears to be consistent with Section 3.3.3, which puts forward a case for the earlier stages of UAS to focus on wider geographical reach while the later stages can then focus on the advancement of technology and narrowing such a divide over time.

To this end, interviewees recommended that policymakers and MNO should adopt a pragmatic approach in terms of deploying a mix of technologies that reflect

[185] One UAS director in Africa

[186] A former group director of public policy for a multinational MNO, who is now an independent policy adviser and researcher

different dynamics within a market. For example, there is a general lack of terrestrial networks in Africa and in some cases, the territorial size of countries like DRC is very large, making it more difficult to extend coverage in a cost-effective way (Petit, 2017; Southwood, 2017). Interviewees suggested that a microwave technology might be more suitable for extending network for flat and valley topography while satellite may be preferred for mountainous geographies. Apart from a country like DRC, Lesotho can also benefit from the deployment of microwave and satellite technologies considering the patches of sparsely populated rural settlements, lowlands and mountains within the country (LCA, 2016). However, the use of satellite has certain limitations in Africa, including the issues of standardisation, speed and high costs of bandwidth (Southwood, 2017; Tredger, 2017). Although the costs of bandwidth have decreased over the years from $3000 a month per MHz to around $600, the Deputy Minister of Telecommunications in South Africa is advocating further reductions to promote wider usage (Southwood, 2017; Tredger, 2017).

Interviewees also suggested that more needs to be done to promote the use of Wi-Fi technology as this can help to provide inexpensive wireless local area networks with the capacity of covering an entire village, depending on the size. South Africa is one of the countries in Africa where the government is championing the rollout of free Wi-Fi hotspots in public places (Project Isizwe, n.d.). Although this initiative is targeted at people in disadvantaged areas with low-income, available evidence appears to suggest its implementation tends to concentrate more in the cities and not in rural areas. For example, the government of South Africa has collaborated with an NGO, Project Isizwe, to deploy free Wi-Fi for the city of Tshwane and over 1,000 free Internet Zones have emerged within this city (Moyo, 2017; Project Isizwe, n.d.). Typically, consumers are allowed up to a daily quota of 500MB with a speed of around 15Mbps (Moyo, 2017). The NGO has also rolled out 408 Wi-Fi hotspots in Johannesburg and Ekurhuleni. While it is not possible to ascertain the reason for not extending such initiatives to rural areas from these secondary sources, it illustrates that the introduction of this initiative is to promote wider access to telecommunications using low-cost technology (Project Isizwe, n.d.).

Furthermore, Konnect Africa[187] is combining Wi-Fi and satellite technologies to close the digital divide in Africa through its SmartWIFI initiatives, which provides hotspot connectivity to end-users using Wi-Fi repeaters linked to its satellite broadband (Letsebe, 2017; Telecompaper, 2017c). This technology is being rolled out in Cameroon, Kenya, South Africa, Tanzania and Ugandan in partnership with MNO and local ISP (Letsebe, 2017; Telecompaper, 2017c). The combination of various technologies provides a more cost-effective solution than sole relying on mobile technologies such as 3G, 4G, etc., Wi-Fi technology has a vital role in complementing other technologies and scaling-up coverage (Donner, 2015; Graham, 2016).

Figure **Error! Reference source not found.** also indicates that the deployment o f heterogeneous technologies encourages the proliferation of innovative solutions such as those championed by OTT. For example, it emerged as part of the findings in this thesis that Google is using fibre network and Wi-Fi technology to promote affordable Internet connectivity in Kampala, Uganda, Microsoft 4Afrika is using TVWS technology to expand coverage in Limpopo, South Africa, and Facebook has launched its 'Express Wi-Fi' initiative across 150 locations in Africa including in Kenya and Nigeria. Regardless of the benefits of such OTT initiatives, other interviewees expressed some concerns. For instance, critics of OTT argued that they are creating and driving value to end-users over the infrastructure that they neither invest in nor pay taxes for.

In addition, there is a whole raft of controversy surrounding the practice of zero-rating such as the violation of net neutrality[188] following the restriction of services to preselected content, the 'actual' costs to end-users and privacy issues. Furthermore, although MNO in Africa allow zero-rating on their networks with some restrictions on voice and video calling, it appears that they face a dilemma as such practice reduce their ARPU due to data free charges and VoIP to transmit telecommunication services. Considering that, zero-rated services are popular with end-users and as a result, act as a catalyst for growing subscriber base, denying access

[187] The owner of Eutelsat, a satellite broadband provider (Economist, 2016).

[188] Net neutrality principle asserts that operators, government and other internet providers treat data access on the internet equitably and without discrimination (Wu, 2003). This is critical to mitigating the abuse of dominant players from using their market positions in gaining undue advantaged, for example, throttling the content of small players (Bauer & Knieps, 2018).

to their networks may result in the loss of customers to rivals. Concerns also lie in the seeming lack of clarity and transparency with regard to OTT business models and resource requirements. This is the reason why one of the policymakers interviewed for this study refused to allocate TVWS to OTT to serve uncovered areas in their country as highlighted in Section 7.3.4.

8.4 Conclusion

The analysis outlined in this chapter has drawn on the public interest and economic efficiency perspectives of market failure as well as the interaction between the data in Chapters 5, 6 and 7 to develop a model for closing the digital divide in Africa. This model is grounded on two key underpinning issues of regulatory capacity and transaction costs as indicated in Figure 19. The decision to focus on these two fundamental issues was informed by the depth of their interactions with the overall findings and their linkages with the country analysis and literature review presented in Chapters 2 and 3. While Chapter 8 is not exhaustive of all the issues raised in the findings, Figure 19 suggests that addressing these two fundamental issues would go a long way in mitigating the persistent low levels of mobile coverage in disadvantaged areas and push the whole agenda of building a more digital inclusive society.

Following the definition proposed for market failure (Section 3.2) and the classification of telecommunications as a mixed good (Section 3.2.1), the regulation of telecommunications should not solely focus on setting the rules of the game, but also promote competition. By doing so, regulation will reflect equity in terms of promoting widespread access to telecommunications and economic efficiency in terms of encouraging and stimulating competition to make it feasible for MNO to economically provide infrastructure and services. To this end, while regulatory capacity addresses the public interest part of the equation of market failure in terms of promoting widespread access to telecommunication, transaction costs underline the economic efficiency aspect to make it feasible for MNO to provide services economically as indicated in Figure 19.

Chapter 3 indicated that there is a trade-off between equity and efficiency, especially in terms of the disparities between social benefit and private cost (Lindsey & Teles, 2017; Todorova, 2016). As difficult as it may be to square these two issues, policymakers need to work with other stakeholders like MNO, civil society and local

communities to find a balance, not least because the public policy objective of widespread coverage in a liberalised market will be better achieved with the cooperation and participation of market actors (Anker, 2017). On the other hand, market actors also need policymakers to help ease the burden of transaction costs of extending access to telecommunications. This is particularly significant as many countries in Africa lack supporting infrastructure with low-income and large rural population, which combine to exacerbate the lack of economic feasibility (Section 5.3). This goes to highlight the need for a balance and cooperation between policymakers and market actors.

Section 8.2 examines the public interest perspective of market failure through regulatory capacity without which a regulator cannot function effectively and efficiently to guarantee equitable access to telecommunications. From policy formulation to its implementation, engaging with wider stakeholders and policing compliance require a considerable level of human and financial resources. Despite this, it is often the case that regulators in various parts of Africa are faced with inadequate regulatory capacity in terms of access to high calibre pool of staff, attracting and retaining people with relevant skills and access to funding. In a country where this happens, it becomes very difficult for the regulator to cope with the complexity that comes with UAS and the industry at large. It then follows that for UAS to address the equity aspect of market failure, it is critical that African regulators are empowered with adequate capacity. Figure 20 indicates that this requires political will on the part of governments to increase the budget allocation of regulatory authorities. Interviewees asserted that the having a well-resourced regulator is a critical success factor in closing the digital divides in Africa, as such, governments should give high priority to regulatory authorities, not least as accorded the collection of USF levy and sector-specific taxes.

On the other hand, Section 8.3 addresses the economic efficiency part of market failure through the lens of transaction costs of network deployment and maintenance. Of all the causes of market failure outlined in Section 3.2.1, the empirical evidence in Chapter 5 suggested that transaction costs are the most significant factor and interlinked with other issues limiting the economic feasibility of coverage expansion. Section 5.3 specifically showed that a lack of economic efficiency, arising from the imbalance between the costs and benefits of coverage expansion, is a major

reason why MNO concentrate in big cities and towns. Interviewees further suggested that aside discouraging MNO from investing in coverage expansion, prohibitive transaction costs also contribute to fuelling the affordability problem via mobile tariff and costs of smartphones. This, in turn, hinders mobile adoption and ICT diffusion.

The analysis above suggests that transaction costs are a fundamental issue when it comes to coverage expansion. This is consistent with the literature (for example, Arrow, 1969; Todorova, 2016; Williams, 1985) that stated that transaction costs are a 'root' cause of market failure. Therefore, transaction costs should not be overlooked when it comes to addressing market failure (Toumanoff, 1984). Interviewees thus asserted that there is the need for policymakers to look for ways to minimise transaction costs in order to encourage MNO and other smaller players to invest more in coverage expansion. To this end, a series of recommendations were outlined in Chapters 6 and 7. However, Figure 21 indicates that the key issues that drew the most comments from interviewees centred on incentives, infrastructure sharing and heterogeneous technologies.

Section 3.2.2 highlighted that one way to correct market failure linked to transaction costs is by offering market actors various incentives in order to encourage them to fill market gaps. Figure 19 indicates that this can be done through a harmonised and reduced system of taxation. This comes on the back of the findings in Section 5.3.3 that the practice of imposing multiple taxes on the sector is fuelling the increase in transaction costs, which then impinge on the ability of MNO to extend their footprint. This also feeds into the affordability problem in terms of the costs of mobile tariffs and smartphones in relation to income levels. Interviewees suggested that policymakers could ease the burden on the industry by offering tax breaks. This can promote more investment in network expansion and encourage the availability of affordable smartphones. It was also suggested that the tax policy in the sector should be structured in a way that reflects local conditions in terms of compensating the market for providing supporting infrastructure like electricity, which contributes significantly to transaction costs.

However, for the use of incentive be effective and efficient, regulators need to enforce compliance to ensure that beneficiaries are held accountable and provide what they ought to for enjoying such benefit (Section 3.2.2). Furthermore, incentivising the industry with benefits like tax breaks comes at a cost. This is illustrated in Niger

Republic's decision to scrap its international traffic tax under the Finance Act 2018 with MNO committing to invest in coverage expansion and the improvement of QoS (TeleGeography, 2017d). Although this decision will cost the treasury around $36.2 million a year, interviewees and studies (for example, Deloitte & GSMA, 2011; Hudson, 2006) asserted that offering such incentive can have a long-term positive impact that trickles down on the wider society. Particularly, considering that end-users can now access a plethora of telecommunication services through mobile telephony, which is fast becoming a useful socio-economic enabler for many across Africa (Collett, 2016; Jagun, Heeks, & Whalley, 2008).

Other costs reduction strategies suggested by interviewees include affordable and timely access to frequency spectrum, infrastructure sharing and the deployment of heterogeneous technologies. Sections 8.3.2 and 8.3.3 have outlined the various dynamics associated with these issues. Altogether, the analysis in Section 8.3 indicates that the issue of transaction costs is critical when it comes to tackling market failure from the viewpoint of economic efficiency. Since the telecommunications market is driven by competition, policymakers need to work with the industry to look for ways to lower transaction costs to encourage operators to invest in coverage expansion because if they are not on board, very little could be achieved.

Chapter 9: Conclusion

9.1 Introduction

Prior to the introduction of liberalisation at the turn of the millennium, the telecommunications sector in Africa was run by state monopolies largely providing fixed network and services (Chavula, 2013; ITU, 2009). The performance of state monopolies left much to be desired in terms of closing the digital divide beyond their capital cities as demonstrated in the low levels of fixed-line penetration across the continent, albeit in varying degrees (see Figure 2 in Section 2.2). This was mainly due to a general lack of investment and technical capacities between countries and regions in Africa (ITU, 1999; Okonjo-Iweala, 2012; Williams & Kwofie, 2014). This resulted in many years of poorly developed infrastructure and a considerable level of unmet demand for telecommunications. With growing pressure to extend coverage on one hand, and a general lack of investment on the other hand, African governments turned to the World Bank and its associated bodies for support (Irwin & Brook, 2003; Sutherland, 2014; Williams & Kwofie, 2014). Prime among the conditions for obtaining such support was the need to introduce wider sector reforms to attract private investment and change governments' participation from ownership to regulation (Ndukwe, 2005; Williams & Kwofie, 2014). It is within this context that the liberalisation of the industry began in the late 1990s and early 2000s (Ojo, 2016; WTO, 1997).

Governments across Africa gradually introduced liberalisation and embraced mobile telecommunications with the understanding that it is more cost-effective to rollout and operate vis-à-vis fixed networks (Deloitte & GSMA, 2012; Souter, 2018a). What has emerged from this process is a complex and dynamic market populated with a mix of local and international MNO (see Table 1 in Section 2.3) whose activities have contributed to an unprecedented level of investment and, by extension, the spread of mobile coverage and diffusion across Africa. With a continental average of 50% mobile penetration between 2016 and 2017, millions of people now have unprecedented access to telecommunications (GSMA, 2016a; 2017b). In addition, mobile penetration and diffusion have created a whole raft of ICT ecosystem so much so that apart from communication, mobile telephony is fast becoming a critical socio-economic enabler across different sectors like agriculture, banking, education, health and politics (Donner, 2004; ITU, 2017a). The implication of this is that access to

telecommunications is no longer considered a luxury but a necessity in light of its enabling capacity and the opportunities it creates (ITU, 2017c; Jagun, Heeks, & Whalley, 2008).

It is, therefore, incontestable that the opening up of the telecommunications market has played a critical role in boosting investment and mobile coverage across Africa compared to the lacklustre performance of state monopolies. Nonetheless, studies have found that while market liberalisation has drastically reduced the coverage gaps in densely populated urban areas, the same cannot be said of disadvantaged areas[189] where a significant number of people lack access to mobile telecommunications (Foster & Briceno-Garmendia, 2010; Manimohan, 2013; GSMA, 2016b). The effort of various governments to address this market failure of uneven mobile coverage gave rise to UAS policy – a move that resulted in the establishment of USF in over 30 countries as the regulatory tool to bridge the digital divide in the continent. However, attaining widespread access with USF has also proven to be difficult following the projection that over 500 million people across Africa still lack access to telecommunications, allowing digital divide of uneven mobile coverage to persist (Collins, 2015; Foster & Briceno-Garmendia, 2010; GSMA, 2016b; 2017b; Manimohan, 2013; Manson, 2013; UNCTAD, 2017). This point to a research gap, which this study investigated by raising two critical questions re-echoed in Section 9.2. While Chapters 5, 6 and 7 extensively presented the findings for these questions, Chapter 8 discussed the fundamental underpinning issues that cut across the findings chapters. Section 9.2 will provide the key summary of these findings while Section 9.3 outlines the contribution of this study. Section 9.4 highlights the study limitations and Section 9.5 draws attention to areas for further research.

9.2 Key findings

Chapters 2 and 3 outlined that whilst the liberalisation of the telecommunications sector and the subsequent establishment of UAS policy have led to more mobile subscribers than ever before, over 500 million people remain unconnected across Africa (Collins, 2015; GSMA, 2016b; Manson, 2013). This prompted two critical research questions:

[189] Under and unserved rural and sub-urban locations (Section 1.1).

RQ1 - *with the introduction of market liberalisation and the establishment of UAS strategy like USF, why does the digital divide of uneven mobile coverage persists areas across Africa?*

RQ2 - *how can the digital divide of uneven mobile coverage be mitigated?*

The study adopts a multiple case-study approach to answer these questions with examples drawn from across Africa and other parts of the world, including Latin America where the deployment of USF was pioneered (Hudson, 2010; Stern & Townsend, 2006). This was supplemented by 28 interviews with various stakeholders who have hands-on experience and play key roles in the telecommunications sector across Africa as well as other jurisdictions. Sections 9.2.1 and 9.2.2 highlight the key findings of RQ1 and RQ2 respectively.

9.2.1 Key findings for RQ1

RQ1 explored the reasons why low mobile coverage persists in disadvantaged areas across Africa despite market liberalisation and the establishment of USF. Drawing on the analysis of the theory of market failure outlined in Chapter 3, it is apparent from RQ1 that USF was established to promote public interest since market liberalisation and competition are driven by economic efficiency[190]. The investigation under RQ1 revealed that since not all areas within a country are actually or perceived as commercially viable, governments across Africa resorted to the regulatory instrument of USF to promote public interest and ensure widespread access to telecommunications. However, the poor implementation of USF due to the interaction of complex issues outlined in Chapter 5 has resulted in the failure of USF to facilitate connectivity for the unconnected.

Figure 12 in Chapter 5 indicated that a lack of regulatory capacity is one fundamental issue at the heart of the complex issues responsible for the poor implementation of USF. This is in terms of regulatory authorities having access to qualified staff, funding and skills to formulate robust UAS policies, implement and effectively monitor the operation of USF. Hence, the ability of USF to close the digital divide is limited, causing disadvantaged areas to lag behind. While Figure **Error! Reference source not found.** in Chapter 8 highlighted that the problem of regulatory capacity can be linked to a lack of political will on the part of the government to

[190] That is, profit maximisation, a lack of which would result in market failure.

allocate more resources to a regulator via budgeting, Figure 12 also showed that factors like corruption and fund diversion contribute to depleting regulatory capacity. This is evident in countries where policymakers either divert USF for their personal use or reallocate funds to non-coverage related projects as illustrated in the cases of Kenya, South Africa and Zimbabwe in section 8.2.2. This puts disadvantaged areas in the state of a double whammy: if they are not neglected due to the poor implementation of USF arising from a lack of regulatory capacity fuelled by corruption and fund diversion, they are overlooked by MNO who, unsurprisingly, are driven by profit.

With regards to profitability, Chapter 5 indicated that MNO will typically base their decision to invest in network expansion on cost-benefit analysis, making the transaction costs of network deployment and maintenance the second fundamental issue that helps to explain why low mobile penetration persist areas across Africa. More often than not, areas where costs are perceived to outweigh returns will get little or no attention from the market as MNO are keener on commercially viable locations. Although the deployment of telecommunications is generally considered capital intensive, Chapter 5 identified various reasons that tend to exacerbate the costs burden in Africa, which then limits the feasibility of providing services economically. These include, for example, the costs and difficulty of securing rights of way (Section 5.3.1) and spectrum frequency (Section 5.3.2) coupled with a great degree of lack of supporting infrastructure like electricity. Apart from the effect of making the costs of network deployment prohibitive, such practice also feeds into affordability issues as market actors like MNO and handset vendors shift the costs burden to subscribers, which then limits mobile adoption and usage (Section 5.3.4).

9.2.2 Key findings for RQ2

In an effort to mitigate the issues identified under RQ1, Chapters 6 and 7 explored RQ2, which resulted in a series of recommendations by interviewees, including a model that could be executed by policymakers to amend and improve how USF are managed and operationalised (Section 6.2). Recommendations were also made in Chapters 6 and 7 on how the transaction costs of network deployment and maintenance could be lowered so that it becomes feasible for MNO to provide services economically. The purpose of which is to attract more investment in the sector because… *the digital economy in Africa will not happen without capital* (investment) (Johnson, 2018).

Overall, Chapter 8 argued that a good starting point to begin addressing the complex and interconnected issues that emerged from RQ1 and RQ2 is by focusing on the two key fundamental issues of regulatory capacity and transaction costs. The decision to focus on these two key issues was informed by the depth of their interactions with the overall data and their linkages with the literature review in Chapters 2 and 3. More specifically, the analysis in Chapter 8 draws on the public interest and economic efficiency perspectives of market failure to develop a model that argues that - UAS policy should be formulated in a manner that empowers regulatory authorities with adequate resources to promote widespread access to telecommunications and, at the same time, facilitates economic efficiency to make it feasible for MNO to provide infrastructure and services economically.

For example, a regulator that is well-resourced[191] with adequate regulatory capacity stands a better chance of managing and deploying USF successfully to ensure the proliferation of mobile coverage to disadvantaged areas. Such a regulator is also more likely to have the competence to engage with MNO and equipment/mobile devices vendors in addressing the problem of affordability - which is acting as a major impediment to mobile adoption and usage in Africa (see Section 5.3.4). For this to happen, governments need to see the empowerment of regulators as a necessary condition not only for advancing UAS, but also for the overall success of the industry. In a dynamic industry like telecommunications with all the complexity that it entails, a poorly resourced regulator stands little or no chance of exerting itself on the industry. For instance, while Section 7.3.4 highlighted that OTT activities are emerging in dealing with UAS and the wider digital divide, evidence from the data also suggests that OTT have their own agenda.

It then raises the question of how regulators across Africa, who are largely faced with limited capacity, can cope with OTT like Facebook and Google. It is difficult enough that regulators are dealing with powerful MNE like MTN and Airtel, but now they also need to deal with OTT including the technological changes and services they are introducing to the market. This brings different sets of dynamics in terms of agenda, drivers, and magnitude, as such, adds to the complexity the regulator has to deal with. One could then argue that a lack of regulatory capacity would not

[191] That is, having access to financial resources, qualified staff and skills.

only impinge on the ability of a regulator to set the rules of the game, but may also erode public interest as market actors may usurp their market positions to gain undue advantage.

From the economic efficiency perspective of market failure, the need to address the concerns raised about the transaction costs of network deployment and maintenance emerged as a fundamental underpinning issue. The reason being that policymakers may say they want to close the digital divide, but how would they achieve this without the cooperation and participation of MNO whose investment and technical expertise are critical for coverage expansion? Essentially, no matter how well policymakers plan for USF, if operators are not on board, very little can be achieved. It was argued in Chapters 3 and Chapter 5 that the deployment of telecommunications is highly capital intensive. However, the costs burden is far more significant in Africa where there is a legacy problem of a lack of supporting infrastructure like electricity, significantly in disadvantaged areas. On top of that, a one-time allocation of USF, as applicable across Africa (Section 3.4.4), might not be enough to sustain the business model of MNO. Hence, interviewees recommended the need to consider various alternatives to complement USF. Although Chapters 6 and 7 outlined these recommendations in details, Chapter 8 highlighted key aspects of these recommendations.

Firstly, there is the provision of incentives through tax breaks, access to affordable (low) frequency spectrum and rights of way. It came to the fore that these are the main issues exacerbating the costs burden on the industry and, by extension, impinges on the ability of MNO to deploy networks beyond big cities and towns. If policymakers were to address these issues, it would help in reducing the costs burden and encourage further investment in the sector. However, for such initiative to gain traction, regulators need to monitor market activities to ensure that operators are delivering what they promised for benefiting from such incentives. In order words, policymakers should be aware that while the use of incentive as a tool for correcting market failure may be promising, it is not in itself sufficient. This further underscores the fundamental role that regulatory capacity plays in the grand scheme of things as human and financial resources would be needed to execute checks and balances and hold MNO to account.

Secondly, infrastructure sharing was considered as a potential cost reduction strategy that should be promoted by the policymakers and embraced by the industry. There was a consensus among interviewees that collaboration via infrastructure sharing generally reduces the costs of network deployment. However, there was contention as to whether infrastructure sharing is a viable option for deploying coverage in disadvantaged areas as sharing does not necessarily alter unfavourable market conditions like sparse population density and low income. Interviewees argued that the debate becomes promising if other dimensions are considered. For example, the elimination of MTR between operators for serving disadvantaged areas. This will allow smaller players, including LCE to interconnect to the networks of the bigger players at little or no cost and connect disadvantaged areas to the wider information society. It will also encourage wider participation in infrastructure sharing since late arrivals will be reassured that if they can offer competitive tariff, they can win over some customers from the first-mover. Particularly in light of the fact that MNO with a low subscriber base might not see the need to participate in any sharing arrangement due to the high margins of MTR.

Thirdly, the deployment of heterogeneous technologies was seen as one of the innovative ways of lowering the costs of network deployment following the argument that a 'blanket' decision to deploy mobile technologies like 3G, 4G, etc. in all areas may not be a cost-effective solution to coverage. Policymakers and operators were advised to consider a mix of technologies to improve coverage expansion, for example, satellite technology, Wi-Fi, TVWS and solar-powered BTS. Deploying a mix of these technologies on a case-by-case basis with recourse to the needs and conditions of various locations can lead to more cost-effective and innovative solutions for closing the digital divide.

Part of such innovation is the role of OTT in advancing UAS. As with infrastructure sharing, this was another divisive issue among interviewees. While some agreed that OTT activities contribute to the advancement of UAS, others had their reservations. Advocates pointed to infrastructure projects like Google's Project Link in Kampala, Uganda as well as other initiatives like zero-rated WhatsApp and Facebook to support their argument for OTT. Critics, on the other hand, argued that such infrastructure projects are geographically limited to a few countries and concentration in the cities, not in disadvantaged areas where UAS is most needed.

Overall, the thesis argues that the two fundamental issues of regulatory capacity and transaction costs should not be treated by policymakers as discrete but complementary issues. This is in line with the conceptualisation of market failure in this study, which asserts that: government intervention is not only for the benefit of the public (equity), but also to stimulate competition (economic efficiency). Although the purpose for UAS is to guarantee widespread access, for policymakers to achieve this, they need the cooperation of market actors like operators and vendors whose activities are vital for the realisation of any public interest objective. As such, policymakers need to be pragmatic in formulating policies that would not only account for public interest, but also ensure economic efficiency in terms of reducing the costs burden on the industry to encourage more investment in coverage expansion. This is arguably a difficult task for the regulator to manage not least because of the divergence between social benefits and private costs of telecommunications (Section 3.2). However, Chapter 8 argued that this difficulty could be mitigated with strong leadership and political will from policymakers and their willingness to conduct wider stakeholder engagement.

9.2.3 Summary

Considering the highlights in Sections 9.2.1 and 9.2.2, it could be argued that regulatory capacity and transaction costs are two key fundamental issues when it comes to addressing the digital divide in Africa. Since the gaps in digital divide could be widened or narrowed by the interaction of these two key issues as indicative of Chapter 8, one could argue that they play a mediator role. Mediator factors help to explain the relationship between a dependent variable (DV), that is, the object of study, and an independent variable (IV), which are factors influencing the object of study (Baron & Kenny, 1986; Saeidi et al., 2015; Umar, Derashid, Ibrahim, & Bidin, 2018). For example, consider a situation where salary (IV) has a positive influence on education (mediator variable) and education, in turn, has a positive impact on health-screening expenses (DV). If the effect of education is removed, the relationship between salary and health-screening expenses becomes invisible (Fung, 2013). Mediator factors thus help to explain the process whereby one event leads to another (MacKinnon, Coxe, & Baraldi, 2012).

In the same vein, regulatory capacity and transaction costs are two key mediators in this study in the sense that they, by and large, help to explain the relationship between digital divide (which is the dependent variable in this case) and the supply-side barriers (which together with the demand-side barriers are independent variables) as indicated in Figure 22.

Figure 22: Key mediating factors for closing digital divide

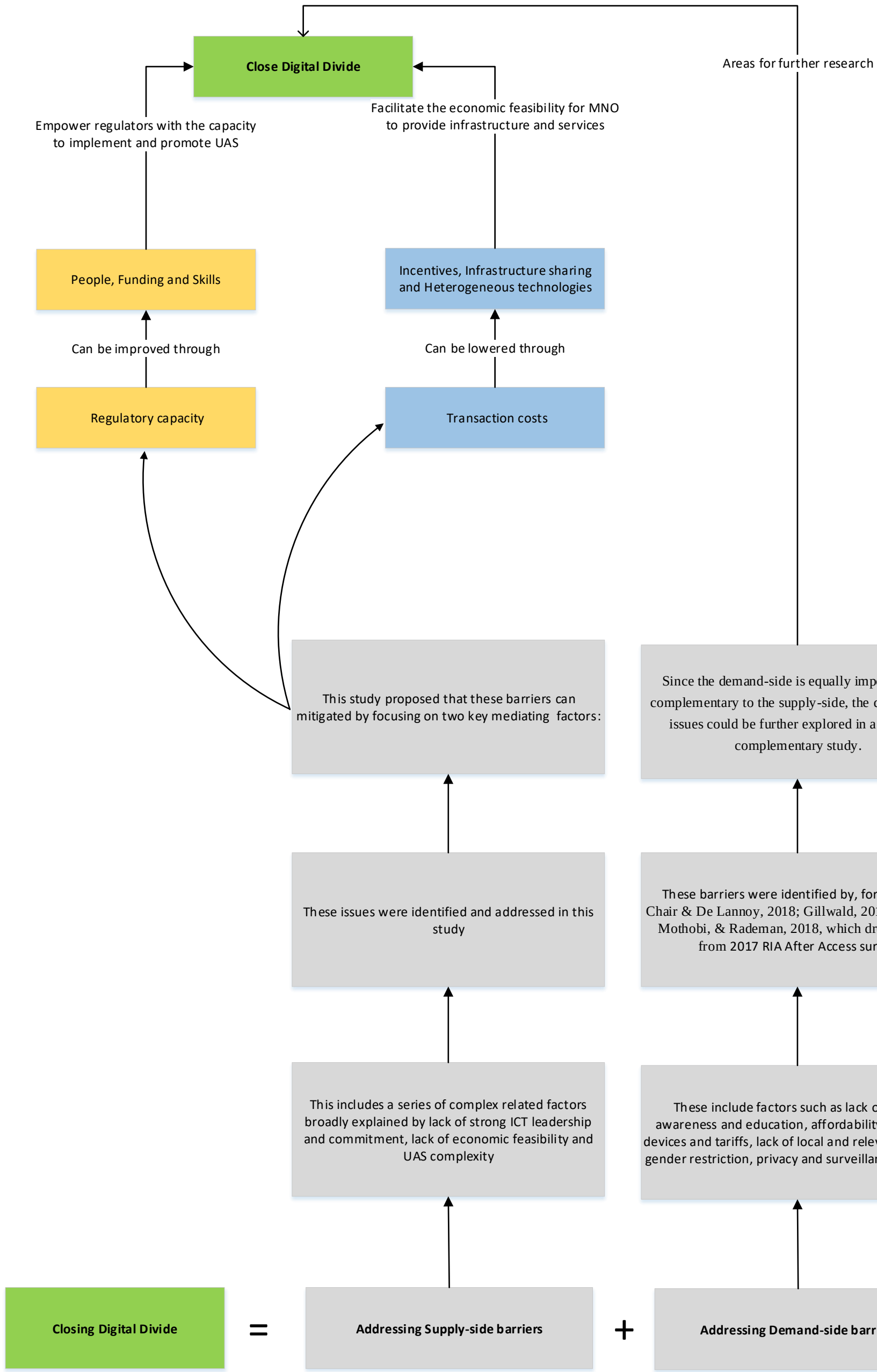

Figure 22 indicates that when issues relating to regulatory capacity and transaction costs are not tackled, barriers (particularly from the supply-side) could increase and digital divide would persist. On the other hand, if efforts are made to tackle these issues, barriers would decrease and the gaps in digital divide would narrow. Figure 22, therefore, highlights an indirect relationship between regulatory capacity, transaction costs and digital divide. For example, when regulatory capacity like skills and funding are increased, this would enable regulators to better monitor and enforce USF commitment with the implication that barriers to improving UAS would reduce and gaps in digital divide would close (Section 5.2.2). Conversely, when regulatory skills and resources do not keep up with changes, this leads to poor USF monitoring and enforcement, which would then increase the barriers to UAS and, by extension, widen the gaps in digital divide (Section 8.2). In terms of transaction costs, when, for example, incentives like taxes and affordable access to (low) frequency spectrum are offered to MNO, this would facilitate economic efficiency and make network deployment more economically feasible (Sections 8.3.1 and 8.3.1.2). This, in turn, would encourage MNO to increase network expansion and close the digital divide (section 8.4).

It then follows that an increase in regulatory capacity and a decrease in transaction costs would result in narrowing the gaps in digital divide and vice-versa. Figure 22 thus suggests that addressing these two mediating factors would go a long way in mitigating the persistent low levels of mobile coverage in disadvantaged areas and push the whole agenda of building a more digital inclusive society. Furthermore, Figure 22 further echoes the caveat in Section 1.1 that although closing the digital divide is a function of both demand-and supply-sides, this study has largely focused on the supply-side. However, studies (for example, Chair & De Lannoy, 2018; Gillwald, 2017; Gillwald, Mothobi, & Rademan, 2018) have drawn on the 2017 RIA After Access survey data to highlight that demand-side barriers like unaffordability of smartphones and/or mobile (data) tariff (also highlighted in this study), gender restriction, privacy and surveillance concerns can also cause digital divide to persist. As such, Figure 22 indicates that there is a need for a separate complementary study to address, in-depth, the demand-side issues without which the infrastructure supplied

would be redundant, ultimately stymie further investment in coverage expansion and allow digital divide to persist.

9.3 Contribution to knowledge

When we compare the body of literature that has explored the development and liberalisation of telecommunications industry in the advanced economies (for example, Boylaud & Nicoletti, 2000; Cabanda, 2001; Clegg & Kamall, 1998; Clifton, Comin, & Diaz-Fuentes, 2011; Crandall, 2000; Curwen & Whalley, 2006; Gerpott & Jakopin, 2005; Henten, 2007; Jakopin & Klein, 2012; Sarkar, Cavusgil, & Aulakh, 1999; Ure & Vivorakij, 1997; Whalley, 1999) and Africa (Aker & Mbiti, 2010; Chavula, 2013; Curwen & Whalley, 2014; Dike & Rose, 2018; Gebreab, 2002), it is obvious that the liberalisation that has occurred within Africa is under-investigated. This study, therefore, contributes to populating a gap in the literature with respect to the liberalisation of mobile telecommunications in Africa.

Firstly, this study revealed that following the liberalisation of the sector, FDI flows emerged as a key driver that has helped to shape the development of the industry with over $200 billion worth of FDI attracted by MNO between 1999 and 2015 (GSMA, 2016a; van-Huyssteen, 2012). At the end of 2016, this study finds that over 186 MNO were doing business across the 55 countries in Africa, 70% of which were either jointly or wholly owned by MNE. As a result of the activities of these MNE, the continent now has varying levels of mobile penetration with countries in Northern and Southern Africa recording rates above 100% while the interior countries, particularly those located in Eastern Africa, are struggling to achieve the same levels as illustrated in Figure 4 (Section 2.2). Drawing on several studies on digital divide (for example, Gillwald, 2010; ITU, 2017a; ITU & UNCTAD, 2007; James, 2009; Pick & Sarkar, 2015; van Dijk, 2005), Section 2.5 found that, for example, socio-economic issues like civil war and political instability are some of the pull factors that have limited widespread mobile coverage in Eastern African countries such as Rwanda and Somalia.

Furthermore, geographical conditions such as the proportion of urban-rural population, can help to explain the digital divide in a country like Burundi, which has over 90% rural population compared to a continental average of 50% (World Bank, 2016). Considering that MNO typically concentrate on commercially viable areas, the

majority of rural areas are often left behind (GSMA, 2013b; World Bank, 2017). The disproportionate level of digital divide in Eastern Africa can also be linked to the nature of telecommunications policy and regulation acting as a hindrance to sector reform and competition because while over 50 countries have introduced competition across Africa, four countries still operate a monopoly, three of which are in Eastern Africa as shown in Table 2 in Section 2.5. This includes Ethiopia with over 100 million people - the second largest population in Africa behind Nigeria – over half of which are unconnected as evident in its 42% mobile penetration rate as shown in Table 2.

Although Section 2.2 argued that the headline figures for mobile penetration in Africa are somewhat misleading and overstated due to multiple SIM usage, Figure 4 suggests that digital divide also persists in other regions, albeit disproportionate to Eastern Africa. This is also evident in the comments of interviewees as they reflected on their experience across Africa. In light of the inaccuracy that comes with multiple SIM usage, this study proposed a rather more nuanced term – 'SIM card connection'. This appears to be more useful when it comes to emerging markets like those in Africa where the wide duplication of SIM cards tend to underestimate the issue of digital divide as the headline figures of mobile penetration appear to be overstated. This would help in differentiating subscribers from subscriptions as one subscriber may have more than one subscription or one subscription being used by several people. This may be a starting point for policymakers, academics, researchers and practitioners to begin to address the misleading figures currently being reported and contribute to the gathering of reliable data for planning and executing UAS.

Regardless of the distortion caused by multiple SIM usage, Chapter 2 indicated that market liberalisation has brought an unprecedented level of transformation to the telecommunications sector compared to the state monopolies regime. This has led to a dynamic market dominated by telecommunications MNE who have increased their footprint across the continent by adopting GI and JV in the earlier stage of market liberalisation, but as the market evolved, M&A appears to be the most preferred FDI strategy (see Table 1 in Section 2.3). Section 2.3 argued that this is due to the opportunities presented by M&A, which includes entering and integrating into a new market quicker, costs reduction in terms of network deployment and market entry, access to affordable spectrum/GSM licence and existing subscribers. From all indications, M&A would most likely continue to dominate the scene as the industry

continues to evolve and tilt towards consolidation as illustrated with the cases of Airtel and Tigo in Ghana, Airtel and Telkom in Kenya driven by an effort to reduce transaction costs and stem losses (TeleGeography, 2017a; Wafula & Miyungu, 2018). Although Airtel's mobile footprint is down to 14 countries from 17 at the end of 2016, the Indian MNO is currently planning to sell 25% of its total African operation for over $1 billion (TeleGeography, 2018a). Backer McKenzie (2017) thus projected that M&A activities will 'quadruple' in 2018 to $5.9 billion across Africa and the Middle East compared to the $1.2 billion recorded for 2017.

The projection that consolidation will continue to be an emerging trend within the industry in Africa is further strengthened by the fact that having more MNO in the market does not necessarily result in more coverage as indicated in Chapter 2. For example, most countries in Northern Africa, including Algeria, Egypt and Morocco with three MNO have recorded over a 100% mobile penetration rate. A similar trend can be observed in Eastern African countries where higher mobile penetration markets like Kenya, Malawi, Mozambique and Rwanda also have fewer MNO. This is in stark contrast to countries likes of Burundi, Tanzania, and Uganda with four, seven, and eight MNO respectively and a lower mobile penetration rate (see Table 2 in Section 2.5). Although the country analysis in this study found that, on the average, there are 3.4 MNO per country in Africa, the evidence from Eastern Africa suggested that more MNO have not necessarily translated into better mobile penetration. This is inconsistent with the argument of policymakers in countries like Tanzania and Uganda who are of the view that the presence of more MNO in the market allows for better competition and mobile diffusion (Biryabarema, 2014; TeleGeography, 2014). This study challenges such practice and argues that policymakers need to reconsider their licence issuing policy by conducting proper consultation and market analysis to find other ways of promoting competition as market growth does not necessarily resonate with having more MNO.

Moving away from market liberalisation, the second part of the research contribution is illustrated in market failure and UAS policy. In light of the fact that digital divide persists across Africa despite market liberalisation, governments in over 30 countries resorted to the use of USF as their preferred UAS strategy to close the gaps of uneven mobile coverage. Since government intervention in the market is justified by the need to correct market failure (Ortiz, 2016; Stiglitz, 2010), Chapter 3

began with the analysis of market failure and found that some studies (for example, Christensen, 2010; Picot & Wernick, 2007; Pigou, 1932) argued for government intervention through the lens of public interest - the need to address market failure from the standpoint of promoting equity in terms of widespread mobile coverage for the society. On the other hand, some scholars (for example, Arndt, 1998; Wallis & Dollery, 1999) examined market failure from the perspective of promoting economic interest. Yet, others (for example, McChesney, 1997; Stigler, 1971; Wolf, 1987) support the need to address market failure from a pragmatic viewpoint of promoting both public interest and economic interest.

Drawing on the public interest and economic efficiency perspectives of market failure and the depth of the interaction between issues in the overall data, Chapter 8 identifies two key underpinning issues – regulatory capacity and transaction costs – to develop a model for closing the digital divide in Africa. The model reflected that to address market failure in a dynamic sector like telecommunications, a pragmatic approach that encompasses both public and economic interests is more suitable. The reason being that since telecommunications is a mixed good as established in Section 3.2, it shares both the attribute of a public good and a merit good – a good that is of immense benefit to the wider society but may underprovided by the market due to, for example, incomplete and missing markets. Furthermore, policymakers may say they want to close the digital divide to promote public interest, but how would they achieve this without the cooperation and participation of market actors like MNO whose investment (including USF contribution) and technical expertise are critical for coverage expansion? Therefore, no matter how well policymakers plan to achieve UAS either through USF and/or other strategies, if operators are not on board, very little can be achieved. This highlights the need for a UAS policy that promotes equity and reflects some level of economic efficiency to make it feasible for operators to build networks and provide services economically.

When formulating and reviewing UAS policy, policymakers and other stakeholders like UAS consultants that contribute to policy development should, therefore, execute this task with the understanding that public interest and economic efficiency are more complementary than discrete when it comes to promoting widespread access to telecommunications. In the sense that policymakers cannot achieve UAS alone and operators may find it difficult to attain desirable outcomes on

their own, especially in areas that not commercially viable (Economides, 2004; Wenders, 1998). This indicates the need for a balance and cooperation between policymakers and market actors in building a more inclusive digital society. Considering that this could be a difficult balancing act as policymakers try to account for both social cohesion and economic interest within UAS policy (Bergman et al., 1998), Chapter 8 indicated that this could be mitigated with strong leadership and political will from policymakers and their willingness to conduct wider stakeholder engagement. Overall, Appendix G highlights how this empirical model complements the conceptual framework of the current study to address a critical research gap on closing the digital divide in Africa.

When a comparison is made between the literature available in the area of UAS policy between the advanced markets[192] and an emerging market like Africa[193], it is apparent that there is a lack of academic empirical research on UAS in African countries. Although one may argue that this reflects the history of the sector and the interests of academics, it also somewhat ironic considering that Africa is among the continents of the world where the market has failed to address widespread access to telecommunications (ITU, 2015; 2016). This study addresses a gap in the literature and more specifically, among the first to produce an academic piece on UAS in Africa compared to the existing studies, which are more or less consultancy based sponsored by the ITU and World Bank. The thesis thus provides a different perspective on the policy debate of UAS in Africa. Firstly, although there is a general poor level of performance by USF in Africa (GSMA, 2014; ITU, 2011; 2013; Sepulveda, 2010), the thesis indicates that there are also encouraging signs in some countries from which lessons could be drawn as illustrated by Appendix B, which highlights some examples of active USF in Africa.

Secondly, following a critical review of the literature on UAS and drawing on the responses of interviewees, this thesis argues for the extension of the traditional conceptualisation of UAS to include **assessment** and **awareness** (Sections 3.3.1, 5.3.5.2 and 6.2.1). This is borne out of the fact that when the three traditional principles

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[192] For example, Batura, 2014; Blackman, 1995; Clarke & Wallsten, 2002; Dordick, 1990; Feijoo & Karniti, 2007; Feijoo & Milne, 2008; Hasbi, 2015; Hatta 2008; Longstaff, 1996; Wirzenius, 2008; Xavier, 2008.

[193] For example, GSMA, 2014; ITU, 2011; 2013; Sepulveda, 2010.

(availability, accessibility and affordability) of UAS was first conceived in 1907 (Mueller, 1993), mobile telephony did not exist. Moreover, technologies and services are now constantly and rapidly evolving so much so that the telecommunications needs and the skills to use mobile devices are a moving target. Thus, for UAS policy to be effective and relevant, the existing UAS principles need to be extended to include assessment and awareness – while the former is critical to gauge and reflect the information needs of the society, the latter will enable people to be more knowledgeable about the wider benefit of being connected and to promote digital literacy to facilitate the use technology as it evolves.

Thirdly, since the process of formulating, planning and implementing UAS policy can be a very complex and difficult task, this thesis proposed a series of steps for policymakers to follow in order to achieve the implementation of an effective and efficient USF model. At the heart of this model is the need for policymakers to formulate clear, realisable and measurable UAS objectives in order to mitigate the complexity and ambiguity currently associated with USF across Africa (Arakpogun, Wanjiru &, Whalley, 2017; 2018). Having established clear UAS objectives, policymakers can then set out to collect relevant data, which is critical for planning, resource allocation and implementation (Arakpogun, Wanjiru &, Whalley, 2018). This would also help policymakers to actually measure who lacks what and where the most needs are instead of allocating resources 'blindly' as indicated in Section 6.2.2. These steps are extensively outlined in Section 6.2.

Fourthly, the thesis extends beyond the mere fact that idle fund impinges on USF performance in Africa to unravelling the reasons behind this phenomenon. This includes a lack of regulatory capacity in terms of human and financial resources to deploy funds, a time lag between fund collection and disbursement for projects and arbitrary USF levies, which leads to over-collection of funds (see Section 5.2.5). Previous studies also argued that there is low ICT/mobile usage in disadvantaged areas and that this act as a disincentive for MNO to invest in such locations. This thesis extends the debate and reveals that a series of issues feeds into this argument. For example, low digital literacy, lack of awareness, lack of needs assessments, lack of relevant local content and SIM registration requirements (Section 5.3.5). Therefore, if policymakers and MNO want to address low ICT usage, attention and resources should be channelled into these areas.

The final contributions made by this study are evident in the areas of infrastructure sharing and the role of OTT in extending UAS. Various studies (for example, Cramton & Doyle, 2017; Deloitte & APC, 2015; Opeke, 2017; Ovando, Perez, & Moral, 2015) support infrastructure sharing on the basis that it helps to lower the costs of network deployment, reduce environmental degradation and promote coverage expansion. Opeke (2017, p. 7) notably argued that *"…with continued erosion of profit margins, as well as ARPU shrinking year on year, and encroaching freemium services, network sharing appears increasingly inevitable if African operators are going to survive."* Although the findings in this study are consistent with the arguments that infrastructure sharing could generally help to lower the transaction costs of network deployment and reduce environmental degradation, it differs when it comes to acting as a catalyst to coverage expansion in disadvantaged areas. In the sense that sharing does not necessarily address unfavourable market conditions such as sparse population density, low digital literacy and low income in disadvantaged areas. Furthermore, the thesis finds that infrastructure sharing, especially active sharing and single wholesale network, has failed to gain wider implementation and impact in Africa. This is due to the neglect of critical issues such as a lack of trust, first-mover advantage, On-and-Off Net tariffs, and QoS in terms of costs of network maintenance/upgrade (Section 7.2.1). This thesis argues that a robust policy framework needs to address and reflect these underlying dynamics to help to revolutionise infrastructure sharing and move it beyond the fringes of passive to active sharing of core networks.

Following the announcement in 2015 by OTT such as Facebook, Google and Microsoft to contribute to UAS in emerging markets like Africa (Gillwald et al., 2016; Riaz, 2015), this thesis highlights the role of OTT in coverage expansion. Although OTT argue that they are using zero-rating and other initiatives to bring connectivity to the unconnected, this claim has sparked a divisive debate between the proponents and opponents of zero-rating (Gillwald et al., 2016; Lyons, 2016). Interviewees were also split on this issue with both sides of the debate putting forward their arguments in Sections 7.2.4 and 8.3.3. Since this topic is still unfolding, there is a limited number of empirical academic evidence in general and more specifically with respect to Africa. This thesis, therefore, makes a valuable contribution to a hotly debated issue by adding to the small base of literature on OTT and UAS. This helps to contribute to

the growing body of literature and raises vital issues to be considered by practitioners as they grapple with this emerging and converging trend of digital disruption.

9.4 Limitations

According to Matthews and Kostelis (2011), there is no research without limitations, a researcher needs to acknowledge this and state how the associated shortcomings were addressed. Therefore, regardless of the insights provided by this thesis, the researcher acknowledges that there are certain limitations within this study. Firstly, there is the limitation associated with the method and methodology, which has been highlighted and addressed in Chapter 4. For example, while Section 4.4 addresses the limitations of the qualitative research approach adopted in this study, Section 4.5.3 tackles the shortcomings of the various data gathering techniques employed.

Furthermore, the researcher acknowledges that a limited number of country examples were used for triangulation due to a variety of reasons. One of which is the general lack of consistent and public available data on the telecommunications industry in Africa. Although the data for this thesis was tracked and generated over a three year period from multiple sources, the information for some countries was either difficult to get or not available at all. Several attempts were made at contacting relevant regulatory and MNO figures, albeit with a limited level of success. This is particularly notable among the regulators whose websites were not accessible, hence difficult to get their contacts. This also meant that a few of them were available and willing to participate in the study compared to other stakeholder groups. For example, out of the over 60 correspondence from which 28 interviewees became participants, active regulators were only seven. Even at that, it took well over six months, on the average, to conclude the interview process with key regulatory figures across seven countries compared to one month with MNO, UAS consultants and other stakeholders. Therefore, one may argue that the difficulty of the researcher to secure a more balanced category of interviewees as highlighted in Appendix D may have skewed the data towards academics, independent researchers, industry experts and UAS consultants who accounted for up to 50% of the interviews.

There was also a language barrier as some regulatory documents and websites were not available in English, for example, Mozambique has theirs in Portuguese. Countries in Northern Africa have theirs in Arabic and French with a limited access if

you choose the English version embedded within the websites. The researcher tried to overcome this by using Google Chrome to translate web pages and documents as well as tracking country and regional activities via online sources like ITWeb Africa and TeleGeography.

In addition, although interviewees included key decision makers across various stakeholder groups, the researcher acknowledges that the sample size of 28 participants could be considered a limited number given the enormity of the various issues that emerged from the process. Having more participants across a more balanced spread of stakeholder representation could have helped to improve on the quality of triangulation and further mitigate the risk of bias as previously highlighted in Section 4.5.1.

Consequently, the results of the analysis, to some extent, may have been obscured by these limitations making the study non-exhaustive in terms of geographical limitations and covering more stakeholder groups. However, since most of the interviewees had cross-border experience from dealing with multiple countries across Africa as indicated in Section 4.5.1, the researcher tried to corroborate the information gathered from various sources during the interview process. For example, most of the MNO figures have a footprint across Africa and most UAS consultants recounted their experiences with various regulatory authorities when prodded. Such information was also triangulated with past studies conducted by GSMA, ITU and World Bank.

Finally, it is also interesting to note that when it came to topical issues like the role of OTT and zero-rating, not all interviewees was knowledgeable enough to comment on this as related events were still unfolding. While this is understandable, it was particularly surprising when some key regulatory figures said they did not know what this meant even though there was evidence to suggest that various zero-rated services were being offered in such countries. Hence, the responses received from this question were somewhat limited.

9.5 Future research

The thesis identifies some areas where the contribution and value of this research could be extended. The first is in the area of OTT activities. One of the issues raised by interviewees is the need to regulate OTT because they are deriving value from

infrastructure they neither invest in nor pay taxes for. In view of the issued raised in Section 8.4 where some key regulatory figures have limited or no knowledge of such an emerging topic, it raises the question of how they would regulate what they do not understand.

Secondly, OTT argue that they are contributing to promoting UAS through zero-rating and other initiatives, a position which is contested by many. Furthermore, contrary to the views of critics, OTT argue that the practice of zero-rating does not harm competition and users. Doubt has been cast on such an argument in light of the series of controversies associated with OTT as illustrated by, not least, the recent row of Facebook and Cambridge Analytical data misuse (Kuchler, 2018). Interestingly, this incident coincides with the release of a new data protection law by the European Commission called the General Data Protection Regulation (GDPR)[194] to protect the data of EU citizens collected by small and large companies, including OTT (Espiner, 2018; European Commission, 2018). Some of the key highlights with GDPR include high privacy default by internet platforms, users must now give consent, which can be withdrawn at any time, users can ask companies to wipe their data, users now have the right to access their data, know who and how their data is shared and companies have 72 hours to report data breach (European Commission, 2018). The fine for default can be up to 20 million euros or 4% of the annual global turnover of defaulters (European Commission, 2018). While the impact of GDPR remains to be seen as various national data protection agency like the UK Information Commissioner's Office (ICO) grapple with its implementation (Espiner, 2018), there is no evidence to suggest that African regulators are collectively planning anything like GDPR.

That being said, given the operation of various OTT initiatives across Africa, it would be interesting to see further research in this area. For example, how and what would be the implication of regulating OTT considering the open and international nature of the internet? Another study could explore the cost-benefit analysis of various parties in order to ascertain who is worse-off, end-users or providers? It could also be beneficial to examine the role of OTT in the advancement of UAS of

[194] GDPR came into effect by May 25, 2018.

telecommunications in order to determine if zero-rating and other OTT activities contribute to UAS?

Another area that lacked clarity in this study is infrastructure sharing. On a general note, interviewees agreed that the sharing of telecommunications infrastructure by MNO could reduce the overall costs of network deployment. However, opinions were split on whether it could facilitate coverage in disadvantaged areas. Consequently, a possible area for further research could focus on the 'where', 'what', and 'how' of infrastructure sharing. This would help to unravel where is the right location to share in terms of rural, urban, both or in-between, what part of the sharing should be promoted – active and/or passive, and how should the sharing be done in terms of process, procedures and regulations.

Furthermore, in the light of the continuous evolution of technology, which, in turn, impacts the service preference of mobile users (AfDB, 2013; Goggin, 2008), what services should be covered by UAS? There was a general consensus among interviewees in Section 5.2.4 that the performance of USF is undermined in many African countries[195] who have narrowly defined the scope for UAS. The reason being that since mobile telephony now includes voice and data, targeting USF on voice alone may be counterproductive, as people are now increasingly in need of data almost as much as voice. Although interviewees agreed that USF should be extended to cover emerging services like data, there was a lack of consensus on what form of data should be considered. For example, Interviewee20[196] was of the opinion that for USF to really address digital gaps, the scope has to be extended to the provision of advanced services like broadband. In contrast, Interviewee25[197] disagreed arguing that it is a bit too early for African countries to include broadband within the scope of UAS, as it may not be economically viable at this stage of their telecommunications development.

Although Section 3.5 indicated that a few countries (for example, Ghana, Nigeria, Rwanda and Ghana) have expanded the scope of USF to include broadband connectivity through public institutions like schools, the majority of countries in Africa are yet to do so. Thereby institutionalising another form of digital divide in

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[195] See Appendix A for a detailed result of the analysis of 34 USF in Africa

[196] A former head of an intergovernmental ICT body, now an independent consultant and researcher

[197] One UAS director

terms of uneven distribution of advanced services. Such practice raises series of questions. For example, if it is not economically viable at this stage to include broadband services in the scope of USF in Africa partly due to issues associated with demand side barriers such as affordability and adoption of advance services, at what stage of the development of telecommunications should this be considered? How 'big' should the gap be before such consideration is made? Should the gap remain constant or narrow over time? Is the practice of connecting public institutions like schools and public libraries to broadband a more cost-effective way to go about this?

These unanswered questions further echo the argument in Section 1.1 that there are two sides to addressing digital divide – the supply side and the demand side. While this thesis largely reflects a supply-side view, the economic viability of including, for example, the provision of broadband in UAS raises the criticality of demand-side barriers like affordability, digital awareness and literacy, lack of local content, gender restriction, etc., as identified by 2017 RIA After Access survey (Research ICT Africa. 2017). For example, it was discovered that the lack of access to affordable mobile device limited internet adoption for over 80% of 15-24 year old in Rwanda and 4% in Tanzania, the lack of digital literacy resulted to limited internet usage for over 25% of 15-24 year old Nigeria and 8% in Rwanda, while the lack of local content restricted over 30% of 15 - 24 years old from using the internet in Rwanda compared to over 10% in Tanzania (Chair & De Lannoy, 2018).

When it comes to gender divide, women across Africa were generally found to have limited access to the internet compared to men with varying degrees across countries. For example, while South Africa had a gender internet gap of 12%, Ghana and Kenya had over 30% while Mozambique and Rwanda had over 50% (Gillwald, 2018). However, Section 2.4 briefly highlighted that the digital gender divide appears to be a consequence of a larger societal problem that can be partly explained within the family context where males are more favourable to access, for example, education, social interaction and higher income jobs relative to females.

Therefore, the demand-side perspective has a varied degree of issues, including digital gender divide, which could be explored by future complementary research as indicated in Figure 22, not least, because such research would be useful in unravelling the dynamics within the demand-side barriers. It would also help to promote the

adoption of mobile services without which infrastructure would be redundant, and ultimately stymie further investment in coverage expansion.

Appendices

Appendix A: Summary of the performances of USF across Africa

Country	Criteria							
	policy formulation	scope	selection of providers	selection of targets	stakeholder engagement	accountability and transparency	performance monitoring and enforcement	remarks
Algeria	-	-	-	-	-	-	-	-
Benin	-	-	-	-	-	-	-	-
Burkina Faso	H	H	H	H	H	M	L	Non-operational
Cameroon	L	L	H	L	L	L	L	Operational, mainly telecentres
Chad	L	L	-	-	-	L	-	Operational
Cote d'Ivoire	H	L	H	-	-	M	-	Operational
DRC	L	L	-	-	-	M	L	Non-operational, funds deposited directly to treasury
Egypt	H	H	H	H	-	-	-	Operational
Gabon	L	L	H	L	L	L	L	Non-operational,
Ghana	H	H	H	H	H	M	H	Operational
Guinea	H	H	-	-	-	L	-	Operational
Kenya	-	-	-	-	-	-	-	Still at the process of establishment
Lesotho	H	H	H	H	H	M	H	Operational

Country	Criteria							
Madagascar	H	L	H	H	-	M	-	Operational
Mali	-	-	-	-	-	-	-	Non-operational
Mauritania	-	-	-	-	-	M	-	Non-operational
Mauritius	H	H	H	L	H	L	-	Operational, some operators have refused to continue their contributions due to the nature of its operations
Morocco	H	-	H	H	-	L	-	Operational
Mozambique	L	L	H	-	-	L	-	Operational
Niger	-	-	-	-	-	-	-	Non-operational
Nigeria	H	H	H	H	H	M	H	Operational
Rwanda	H	H	H	H	H	M	H	Operational
Senegal	-	-	-	-	-	-	-	Non-operational
Seychelles	-	-	-	-	-	-	-	-
Sierra Leone	-	-	-	-	-	-	-	Non-operational
South Africa	H	H	H	H	M	L	-	Operational, but temporarily suspended in 2011 when Board members were suspended due to an allegation of corruption, funds are deposited in the National Treasury even when an independent body

Country	Criteria							
								is responsible for managing the funds
Sudan	H	H	-	-	-	L	L	Operational
Swaziland	H	H	-	-	-	L	-	Disbursed $6M to MTN in 2009 and became non-operational
Tanzania	H	H	H	H	H	M	H	Operational
Togo	H	L	H	H	L	L	-	Operational
Tunisia	-	-	-	-	-	-	-	Non-operational
Uganda	H	H	H	H	H	H	H	Operational
Zambia	H	L	L	-	-	L	-	Non-operational
Zimbabwe	L	L	H	L	L	L	L	Non-operational

Source: Arakpogun, Wanjiru, and Whalley (2017, p. 627).

Appendix B: Examples of active and performing USF in Africa

Country	Highlights of USF
Ghana	▪ USF in Ghana (GIFEC) was created in 2004 under the 2001 Ghana ICT Policy for Accelerated Development ▪ to facilitate the provision of services such as basic telephony, internet and multimedia services, other ICT services including broadcasting to unserved and underserved locations ▪ funded by 1% levy on MNO annual gross revenue ▪ contract awarded on a competitive basis – least subsidy tender ▪ the collection began in 2005 but started disbursement in 2007 ▪ cumulative balance of about $20.9M from 2005-2009 year-end ▪ last (public) available balance was estimated at $10.5M in 2011 ▪ examples of projects executed include over 30 sites of rural telephony constructed and activated, over 60 common telecom towers deployed in rural areas, school connectivity for over 200 educational institutions with ICT laboratories and internet connection, etc.
Lesotho	▪ USF in Lesotho (USF) was first created in 2009 under The Communications Authority Act 2000 and Universal Access Rules of 2009, but later reviewed with the introduction of The Communications Act 2012, following changes in telecoms technology and services ▪ to ensure universal access to communication services such as voice telephony, internet access and broadcasting for social and economic benefits of all Basotho ▪ funded by 1.5% levy on MNO annual gross revenue and government subventions ▪ contract awarded on a competitive basis – least subsidy tender ▪ cumulative income of about 75M Maloti was collected from 2010-2014 and an estimation of about 12M Maloti, year-on-year, is projected for 2015 and 2016 ▪ some examples of planned projects include 10 mobile telephone masts and broadband rollout from 2015/2016 including school connectivity, all across unserved and underserved locations in Lesotho

Country	Highlights of USF
Nigeria	▪ USF in Nigeria (USPF)[198] was established in 2007 under The Nigerian Communications Act No. 19 of 2003, Part IV ▪ to promote the widespread availability and usage of network and application services such as individual and public mobile telephony, broadband, telecentres, health centres, etc. in unserved and underserved areas ▪ funded by 1% levy, which is part of the licence condition of MNO ▪ contract awarded on a competitive basis – least subsidy tender ▪ Collection began in 2004, well before the establishment of the fund and disbursement commenced in 2008 ▪ cumulative balance around $146M from 2004-2009 year-end ▪ last (public) available balance was 1.6B naira for 2012 year-end ▪ examples of projects executed include the construction of over 120 BTS across various regions to facilitate mobile telephony access in rural and semi-urban areas, over 1300 schools have been connected under the School Access Project, 74 libraries have been connected across the country under the E-Library Project, etc.

[198] Universal Service Provision Fund

Country	Highlights of USF
Rwanda	▪ Rwanda operates a cross-sector universal access under RURA[199] - Water, Transport, Energy and ICT ▪ Specifically, USF in Rwanda (UAF)[200] was created by Presidential Order 05/01 of 15/03/2004 under the Government Law No. 44/2001 ▪ to facilitate the provision of telecoms services in remote and underserved areas ▪ such telecoms services include fixed and mobile public payphone, broadband, telecentres, school connectivity, etc. ▪ funding based on 2% of operators' gross revenue, less interconnection charges ▪ contract awarded on a competitive basis – least subsidy tender ▪ Collection and disbursement began in the same year – 2004 ▪ cumulative balance around $18.7M from 2004-2009 year-end ▪ from 2011-2015-year-end, UAF received over 11B and disbursed over 5.2B Rwandan Franc ▪ Examples of projects executed include partial funding for the sustenance of one laptop per child (OLPC) initiative launched by international donors in 2007 (see D'Amico, 2011 for more details), deployment of over 30 telecentres across the country with fibre connections, rural telephony projects across different provinces and districts in the country

[199] Rwanda Utilities Regulatory Authority

[200] Universal Access Fund

Country	Highlights of USF
Tanzania	▪ USF Tanzania (UCSAF)[201] was created in 2009 under the Universal Communications Service Access Act, Cap 422 of 2006 ▪ to facilitate access to communication services in economically unviable areas including rural, urban and underserved locations ▪ such communication services include fixed and mobile public telephony, broadband, school connectivity, etc. ▪ funded by 0.3 % levy of gross annual revenue from MNO, ISPs and courier service providers ▪ a cumulative balance of $3M for year-end 2010 is the only financial record we could get on income ▪ however, from March 2013-May 2015, a total of about $36.8M has been disbursed from USF for projects across 1939 villages ▪ a report of 'current project' – December 2015 - from the official website contains a total budget of $36.8M for the execution of planned projects across various locations in the country, but no evidence seems to exist for funds collected or allocated
Uganda	▪ USF in Uganda (RCDF) was established in 2003 under the Communications Instrument of 2002 ▪ to provide access to communication services in the rural and underserved area, e.g., fixed and mobile public payphones, fixed private residential connection, broadband, telecentres, etc. ▪ funded by 1% levy of gross annual revenue from MNO, less interconnection charges. ISPs and couriers service providers also contribute the 1% as well ▪ From 2001/2002 when the fund was operationalised until 2014/2015 year-end, a cumulative income of 128B Ugandan Shilling have been collected and 126.9B Ugandan Shilling have been disbursed on various projects ▪ Over 7000 projects have been executed by USF in Uganda from 2001/2002-2014/2015 including the deployment of over 24000 public payphones, 880 GSM sites, 622 broadband sites, and other 18000 projects including telecentres and school connections across the country ▪ 32B Ugandan Shilling has been budgeted for project execution in 2015/2016 with an estimated income of 22B Ugandan Shilling including 2B Ugandan Shilling donation from Ministry of ICT

Data sources: Compiled by the author from a variety of sources such as regulatory and industry reports, GSMA and ITU databases, etc.

[201] Universal Communications Service Access Fund

Appendix C: Case study protocol

Conceptual framework and Overall research questions

The conceptual framework for the current study is predicated on the interaction between market liberalisation, market failure and UAS policy in Africa in order to explore and address the following research questions:

RQ1 - *with the introduction of market liberalisation and the establishment of UAS strategy like USF, why does the digital divide of uneven mobile coverage persists areas across Africa?*

RQ2 - *how can the digital divide of uneven mobile coverage be mitigated?*

The primary unit of analysis adopted for this study is 'country', delineated by time – from 1999/2000 (the starting point of liberalisation in the sector) until 2016. Although a multiple case study was adopted in this study with country examples drawn from across Africa, a more in-depth analysis was conducted for Eastern Africa as countries in this region have the lowest mobile penetration rate, despite having, on the average, more MNO. Comparisons were also drawn from other regions in Africa (as well as other parts of the world) to illustrate and triangulate the comments of interviewees.

Interview guide and a sample of semi-structured interview questions with probes

Opening - "Thank you for your willingness to participate and contribute to this study. I assure you that all the information disclosed will be strictly confidential in line with the ethical consent form you completed. May I switch on the tape recorder, please…?"

The re-introduction of both the participant and the researcher then follows before the actual interview begins.

Time of Interview:

Date:

Medium: via

Interviewer: Researcher

Interviewee:

ID Code:

Category of Interviewee: Civil Society/Industry Expert

Q1. What are your views on the level of mobile penetration across Africa?

- What would you consider as high level of penetration?
- Do you agree with the assertion that there is low mobile penetration in suburban and rural areas across Africa and if so,
- What do you think is responsible for this?

Q2. What are your views on the operation of universal service funds (USF) across Africa?

- What do you think is responsible for the poor management of these funds in Africa?
- Could you please identify some of the challenges facing the implementation and management of USF in some of the countries you have worked for?
- What is responsible for the idle fund in some countries?
- What would you suggest is needed for an effective and efficient USF?

Q3. Studies have suggested that network and infrastructure sharing among operators may help in addressing the issue of uneven mobile coverage. What is your opinion on this issue?

- Why do you think operators don't do this more often?
- Should or should it not be mandated?
- How can the issue of trust be addressed?
- What role do you think regulations can play here?

Q4. What other ways do you think mobile network operators can be encouraged and/or mandated to do more in terms of expanding and improving mobile coverage?

- Would you suggest other initiatives apart from USF?
- What role can regulation play here?
- Can you please give examples where such mechanism is in use?

Q5. Could you please give insights on how you think multi-stakeholders like regulators, operators, and the civil society can work together to improve coverage in unserved and underserved locations in Africa?

- Any country example?

Q6. What about Zero Rating? Does this contribute to universal access and service (UAS) in any way?

- What about its criticisms (net neutrality violation, anti-competition…?)

Q7. Advocates of universal service are now arguing for the need to rethink the scope of UAS to include new telecom services such as mobile and broadband into the framework as technology is increasingly converging. What is your take on this?

- Since many services are now available, which services should be included in the scope of universal services?

Q8. Are there any other comments you would like to make on the issue of uneven mobile coverage and UAS which you feel my questions have not covered or you wish to reemphasise?

Closing – Thank participants for their time and cooperation, assure them once again of their data protection and confidentiality, ask if they would be willing to review the transcripts of their conversation so as to ensure proper representation of their thoughts, ask for other possible interview contacts, etc.

Appendix D: List of interviewees

ID Code	Stakeholder category and areas of experience	Medium of interview	Date and time	Duration (hrs: min: sec)
Interviewee 1	Access specialist, civil society representative and ICT researcher	Skype without video	6-10-2015 13:00 GMT	1:20:31
Interviewee 2	Deputy director general of a regulatory authority	Face-to-face with notes (no recording)	09-10-2015 13:30 GMT	NA
Interviewee 3	Africa director for government and regulatory affairs of a major OTT	Skype with video	16-10-2015 09:00 GMT	0:24:34
Interviewee 4	Head of access policy for Africa of a major body representing the association of MNO	Google Hangout with video call	06-11-2015 12:18 GMT	0:39:16
Interviewee 5	A long-term UAS consultant and researcher	Face-to-face with a tape recorder	12-11-2015 10:50 GMT	1:21:15
Interviewee 6	Independent telecommunications policy analyst with expertise in Africa and other parts of the world	Phone and Skype without video	02-12-2015 10:01 GMT	0:44:37
Interviewee 7	UAS consultant	Skype without video	17:12:2015 19:02 GMT	1:01:44
Interviewee 8	Access specialist and managing director of a niche provider	Skype without video	19-01-2016 08:58 GMT	0:45:46
Interviewee 9	Head of spectrum administration of a regulatory authority	Email	19-01-2016	NA
Interviewee 10	Director of UAS of a regulatory authority	Email	21-01-2016	NA
Interviewee 11	UAS consultant and researcher	Skype with video	22-01-2016 09:57 GMT	0:52:42
Interviewee 12	Access specialist and the director for business development of a niche provider	Skype without video	22-01-2016 17:07 GMT	0:47:01
Interviewee 13	A key multinational MNO employee in charge of	Skype with video	29-01-2016 07:59 GMT	1:16:16

ID Code	Stakeholder category and areas of experience	Medium of interview	Date and time	Duration (hrs: min: sec)
	regulatory policy across Africa			
Interviewee 14	Head of UAS division of a regulatory authority	Email	11-03-2016	NA
Interviewee 15	Chief information officer of a pan-African MNO	Phone	16-03-2016 14:28 GMT	0:34:09
Interviewee 16	Civil society and ICT researcher	Email	30-03-2016	NA
Interviewee 17	A former multinational MNO executive, now a senior international policy adviser	Face-to-face with a tape recorder	13-04-2016 13:15 GMT	1:02:58
Interviewee 18	Regulatory specialist of an international lending organisation	Phone	19-04-2016 14:03 GMT	0:43:10
Interviewee 19	Senior Director and independent ICT researcher	Skype without video	19-04-2016 15:19 GMT	0:43:19
Interviewee 20	The former head of an international ICT body, now an independent consultant for the ITU and World Bank	Skype without video	22-04-2016 10:07 GMT	0:41:56
Interviewee 21	A former public policy director for a multinational MNO	Skype with video	28-04-2016 10:03 GMT	0:44:35
Interviewee 22	Academic in ICT policy and UAS expert	Phone	11-05-2016 7:30 GMT	0:14:33
Interviewee 23	Former USF CEO, now consulting for the ITU and some countries in Africa	Face-to-face with a tape recorder	20-05-2016 13:00 GMT	1:08:32
Interviewee 24	Academic and UAS consultant	Skype without video	26-07-2016 11:00 BST	0:46:12
Interviewee 25	UAS director of a regulatory authority	Email	16-11-2016	NA

ID Code	Stakeholder category and areas of experience	Medium of interview	Date and time	Duration (hrs: min: sec)
Interviewee 26	Permanent Secretary for Ministry of Transport and Communications	Face-to-face with a tape recorder	15-03-2018	0:35:16
Interviewee27	ICT academic and rural community network expert	Email	19-04-2018	NA
Interviewee28	A former regulatory head	Face-to-face with a tape recorder	15-03-2018	0:35:16

Appendix E: Sample of transcribed interview

Time of Interview: 07:59 GMT (1:16:16)

Date: 29-01-2016

Medium: via Skype

Interviewer: Researcher

Interviewee: A key multinational MNO employee in charge of regulatory policy across Africa

Category of Interviewee: Operator

ID Code: Interviewee13

Opening…

Interviewee13: It is very good that you are looking into telecoms. Everything is about connectivity today. In Africa more people are connect to mobile phones than pipe-borne water. This tells you about how important mobile phone is today. In Africa, as you know since you've worked with the bank, the financial inclusion has failed as less than 10% of the population of Africa have access to formal banking system but when you put the penetration rate of mobile operators together, it is now averaging around 60% and this tells you that we can actually give banking to 60% of the population and it is even easier for us because our distribution model is much more advanced, it is much more practical. You guys can put ATM in wherever you want but it is CAPEX heavy etc. So the banks have failed the African people in general and the mobile businesses are taking over. When I went through your questionnaire, I think that your key question is around: in spite these investments that we have across the continent, do Africa people still have access to these services efficiently? If not, why not? What are the challenges and how can we make it work? I think you've got it right because at the end of the day, yes we are partners of ICT for governments as these are public services and we just get licenses, depending on what you call it. The bottom line is that we just get authorisation to use scarce resources to be able to deploy these public services like banking, just because government cannot do it efficiently. So the governments set up terms and conditions etc. Now when you look at the terms and conditions they come with financial liabilities which mean the business needs to viable. So, you rollout your networks and put the business plan based on areas that are developed. Now when you look at the structures of our countries you only have few cities that represent three quarter of the economy of the country and then the rest of

the country is still very poor and, therefore, there is no incentive for us to go and roll out in those places because you don't get the returns. You can't spend $6000 or $7000 a month on a site that gives you only $200. Now the question is: is there a model that we can use on one hand while we are trying to make sure that we get this business at a level where we can consider it as viable as possible, and at the same time make sure that we cover the rest of the country? So there is the notion of universal service which basically was designed to sort of provide answer to this question where we have to put money aside as part of our contribution in addition to the licensing fees and all sort of taxes. These funds need to be managed to serve as investment for the purpose of deploying networks and providing access to communications services in underserved areas. But the problem with our countries giving the weakness from the government perspectives, people see opportunities with those funds and basically the selection process of the government in managing these funds are not that objective. So we find people managing these funds in a very subjective manner, therefore, corruption get involved and the purpose is not met. So if you do an assessment of liberalisation of telecoms sector across countries say 10 or 15 years ago from the monopolies from which they were liberalised, you will realise that these funds were created but it has not been a success simply because of governance. Now we still, as mobile operators, feel uncomfortable with the fact that our people are not as connected as possible and we are saying that perhaps the answer is in the cooperation between operators which can translate into, for instance, infrastructure sharing. This needs to be further explored because it has different level of complexities. From an infrastructure perspective you have passive and active infrastructure sharing. Passive infrastructure sharing is your tower, buildings, where antennas are placed etc. That is why this form of sharing is easy because there is no point in building it separately, there is no incentive for this because when we have one antenna and we collocate, we would spend less, it would have less impact on our environment and since we spend less there is more incentives to cover more areas that are not viable. But this is still an ongoing discussion because even in areas that are not underserviced, it is something that can help the bottom-line of businesses in general. Now from the active perspective, I mean from the core network itself, this is where the question lies as different companies have different positions. Some have great networks as a result of their level of investment may be to use this as a way of differentiating between themselves and their role in the market.

So some operators are good in some markets and not so good in some markets. In the markets where their network is powerful, they don't want to share because they want to keep their market leader advantage but in markets where they are weak, they want to request sharing. So there is still not enough trust, people are saying this is our bread and butter; we cannot share it with you. So there are different school of thoughts in terms of infrastructure sharing but definitely it is the way to go as it will help us spend less and reach the most remote areas and fulfil that obligation from a rural coverage perspective. More cooperation is required. There is a pilot project we started in ***** (name of a country)** where we decided ***** (name of operators)** (interruption by PA) …One thing that does not really help is the long-term focus of politicians. I deal with different Ministers, Presidents, and Governors across the continent both here and my previous job, I have a concern from a vision perspective. Today I am not sure if our approach as government gives enough incentives for foreign investor to feel comfortable to invest sufficiently. The tax pressure is extremely high and increasing by the day. You have the general tax, the income tax, and then you have what we call telecoms-specific tax, inbound tax, SIM cards import, handsets, tax on literally everything. Now, what that does is that it puts pressure on the viability of the business and as a business, since we are not NGOs, we can only pass that on to the customers and this makes the service a bit more expensive and it does challenge the affordability. What that does it that it reduces the basis on which tax needs to be paid and ultimately it reduces our contribution to government. Although we try to explain these scenarios but government do not seem to think about the long-term, they see short term and this is linked to political situations where people think only in terms of their tenure in office. So they want to collect now, there is no long-term views. This also does not help in terms of incentivising operators to invest enough. You also have the regulatory framework in general where cost of spectrum is priced beyond any business plan. We had an instance in ***** (name of a country)** where we have 5 operators, which is already too much, and they wanted to sell 4G LTE spectrum on auction and the reserve price was around $62 million. Now when you do a business plan, you realise quickly that you cannot get that money back as it is simply too expensive. Actually if they can give us spectrum for free, we would serve the service and the data freely and ultimately we would make more money and contribute more to government. So there is an issue regarding the regulatory intervention. In some countries every month you have new

regulations which translate to cost in terms of compliance. The regulatory pressure across the continent is increasing and this is also due to the fact that the economic situations are not heading in the right direction, price of oil has dropped and government is struggling to get revenues. Just to summarise these points, on one hand operators need to make efforts to be more efficient through infrastructure sharing etc. and find solutions that can help underserved areas and on the other hand, governments need to create an environment that is conducive to investment and create enough incentives for operators to cover every area that is not properly covered.

R: What are your views on the level of mobile penetration across Africa?

Interviewee13: Numbers speak louder but I lack them. There is a lot of potential in the continent and today the average penetration rate is about 60% across countries which simply suggests that there is still more work to be done and there is a lot of opportunities for operators. There needs to be a lot of effort…the 60%, by the way, is just voice penetration but data penetration is around 12% which is still very, very low. So there is a lot of work to be done not only from an operator's perspective but the government needs to create an environment that will lessen the burden on operators and create enough incentives to invest but there is a point regarding manufacturers. We need to see handsets that are affordable…the affordability of handsets is a very critical issue because today data is becoming more important than it was a few years ago with the advent of social networks etc. So smart handsets affordability becomes a big question hence the manufacturers also have to come into play in this instance. So for everybody, there are still a lot of opportunities going forward. When the other markets in the US and Europe are looking at us, they feel that we are at a better place because those markets are saturated with over 100% penetration and now, they are working on data. So we still agree with the fact that there are a lot of opportunities, there is a need for efficiency for the government, for operators, and the manufacturers of handsets who are going to play a big role. I am stressing manufacturer of handsets here because the issue of affordability in Africa is still a big issue. So it is important to think of creating handsets that are both smart and affordable given the growing needs to consume data. So this is really the position I would give.

R: What are your views on the operation and management of universal service funds (USF) across Africa?

Interviewee13: I think the idea of USF was a great idea and it is still a great idea but the challenge comes from the governance side of it, the model, and structure that is needed to manage the fund. Maybe the fund needs to be managed by a joint venture that the operators can create with enough scrutiny in terms of managing the investment because it just has to be managed at the same level with any other business with strong internal policies that any commercial business has. From this perspective, not only would the fund benefit from the expertise of the operators but also from their way of doing business, which from my view, I think we are good at what we are doing so we can manage the fund better, but when it is politicised, it becomes an issue. That is where the challenges come in. So to answer your question: I think it is still good but we require improvement on how the funds should be managed. The government needs to consult a bit more, take leadership in accordance with submissions made by operators, which seems to be a challenge so far. This issue is not whether or not to have the fund but how it is managed. That is the key issue.

R: What are your views on the policy formulation and implementation of USF/UAS across Africa?

Interviewee13: To come up with efficient policies you have to consult the industry as they have the expertise. Unfortunately, the different countries across the continent do not operate at the same level and this translates into consultation problems. Ideally, consultation process needs to be transparent; it needs to be prescribed in a way that is above all the stakeholders and by involving all the stakeholders, it would be fair and would fulfil the public interest. This is so because telecom services need to be provided in the public interest. So in drafting these policies, governments need to have one priority in their minds: public interest. In drafting licences, public interest needs to be the ultimate target. Public interest simply means the interest of the consumer and enough incentives for investors. If you have these objectives in mind, you would make sure that all the stakeholders are involved because they play a great role. I just gave an example of handset manufacturers. Why would you, in a place where service is so expensive and penetration is so low, impose tax on handsets importation? Not only would that lead to unaffordability, it does not create incentives for manufacturers. So if you take off that tax on handsets importation, it means less cost to a consumer that is already poor. Putting all these tax pressures on operators and manufacturers would translate into high cost of telecom services. Is this in the public interest? When you

are making the lives of investors miserable to the point where they are not sure if they should stay in the country or not simply because they are being harassed daily, is that in the public interest? When all these costs of regulation make the lives of operators so difficult that even the profitability becomes a big question because there is a big question on profitability today. You cannot have a situation when the penetration rate is still low at 10% or 12% on the data side and 50% or 60% on the voice side but the businesses are not making money, there is a problem. So these are the questions we still have. So in terms of consultation processes, you should make sure that politics does not take over in such a technical environment. Let me explain to you what politics does. Politics make sure that you appoint a minister who has no clue of what telecoms services mean and the applications of these services. Such political agenda will undermine the citizenry as it would not be in the public interest but if a minister who has enough experience comes into the country with an objective that is linked directly to public interest, he would put a transparent system in place, he would consult all the parties, he would put in place laws that encourage investment, create incentives for innovation and ensure that consumers have the best products. This is what I mean by public interest but where we are today suggests that politics is taking over a critical and technical sector such as telecoms environment which needs to be run by experts. We have a problem in Africa in terms of best practises that encourages government to have independent regulators…just like in the banks you have an institution that is independent whose position is not politically affected without fear or favour and that would drive the public interest. If you look at the US-FCC, if you look at the UK-Ofcom, if you look at other developed countries, the effort is made. Obviously you cannot have an institution that is separate from government but independent comes from the fact that the process that has been put in place to create that institution, appoint people to run that institution does not allow government to give them direct instructions in terms of how they should run the sector. So you would see, for instance, that the funding model does not directly depend on government, specifically the ministry of telecoms. You would find that the appointments of the board of directors including the DG, depending on the model, are people nominated by government but appointed by a diverse institution such as the parliament. Therefore, the president does not have the right, for instance, to pick and choose but he or she can either appoint or reject a nomination by sending back the nominees list for further consideration but he

cannot specifically pick the nominee. What this does is that the parliament looks across the sector, select the best people and recommend. When these people are in office, they don't have a relationship with any department that would tell them what to do. They answer to parliament and they don't depend on other institutions in terms of funding which makes them independent in terms of the context in which they operate and from this perspective, it means they will run the sector effectively. But what we find in Africa in most of the cases is that they put together a legal framework that makes the regulator basically a division of the department of telecoms or an office in the presidency. This means they will take any political decision; they will be subjected to any form of political interference and put in question, the objectivity of the sector.

R: What are your views on network and infrastructure sharing among operators?

Interviewee13: I think as operators we have increased our level of engagement because we feel that we would provide more value to the sector by looking at efficiency and one of the ways of doing it is by sharing infrastructure. This is a very interesting area to look at. The principle, when it comes to infrastructure sharing, is something that we align but the question is: in practice, what does it mean? So there are different views in terms of how we do it even when you look at the active infrastructure, there are different levels. Some people feel that you don't have to go as far as sharing spectrum, for instance. Some people feel that depending on the deepness, there are certain limits. So these are issues that need to be aligned but in general terms, infrastructure sharing is the way to go and this is really positive in many ways including the fact that we actually need to care about the environment. We need to start making sure that whatever decision we make is environmentally friendly. So from this perspective as well, infrastructure sharing is definitely the way forward.

R: Studies have suggested that although UAS may be an obligation at the beginning but with time, it may become an opportunity due to network externalities considering factors like urban-rural communication. What is your take on this?

Interviewee13: If I may put your question differently, do you mean: can we look at underserved areas as an opportunity?

R: Exactly.

Interviewee13: Yes, I see it as an opportunity. We have done something in this area in *** **(name of a country)** by looking at how to stimulate data consumption for last-service-mile (LSM: low income earning people in remote areas) customers and actually make profit out of it. This was a very interesting exercise. We took smart handsets with a lot of data and gave it to a group of people in some villages and after a month, we realised that they did not use the data, they only used probably a tenth of the data. Why? Because they did not know what to do with all the data we gave them. I am sure if I were to give it to you, you would access content, you would access movies, you would do research because you have the knowledge to use the data. So we realised that given them handsets with data is not the solution. There were dimensions that needed to be added: relevant content and education. So this is to say that rolling out network in these areas and giving people smart handsets to drive data usage was not the complete answer, there was a dimension that needed to be added. Today you access this content because it is in a language you understand but there are a lot of people that do not understand English, for example. That is one, but secondly, you know how to read. We still have people in our remote areas who can't read. Now, what are they going to look for? So giving such to people who don't know how to read simply means the people would not access such content, hence, the issue of relevant content where people create their own stories. In *** ***** **(name of a country)** they call it local content. Local content in ********* **(name of a country)** means something else since they are contributions made by locals. Take DSTV as an example. DSTV in the past was a rich people channel and they aired content from the US, from the UK and they realise over time that we need to make the content in our bouquet relevant and affordable. So when they started putting African Magic and other African Channels and other local content, it became relevant for the locals and they reviewed the price. The channels that were providing local contents made a lot of money as they started covering a larger base. So they created a model to access LSM people with relevant content and lower rates. I am sure that in the Nigeria of today, DSTV is not as a luxury as it used to be ten years ago as nearly everyone now has access to DSTV even people in the shops can afford it but when you look at the revenue they are making out of it, it is massive. So the issue about remote areas profitability is just about the business model. So to answer your question: we have to think about a number of things including relevant content and education to stimulate usage in remote

areas because the perception today is that those places are not viable but when you fine-tune your business model, you can make it viable - you have to give them a product that they understand. If you look at in Nestle, they started making small chocolate instead of only the big ones they used to. You will also see Coca-Cola making small bottles of coke; you will see even soap companies making small ones etc. These things are bought by the masses bit-by-bit but the scale gradually become massive. So you just have to find the business models that address their need. So in the telecoms sector, there is need to create what people understand and in their language as well and they also need to be educated on how to use it. A megabyte does not mean anything to my mother, but if you tell her that 'with a megabyte you can watch a movie, you can watch a film from your village, and it can last for x number of days, you can call your son on skype for 30 minutes a day for a week etc.,' then it begins to make sense to her. In order words, when you list the things she can do with a megabyte, then a megabyte makes sense to her. It is linked to education. So yes it is viable but there must be a more specific business model to address specific needs of the underserved people.

R: What other initiatives would you recommend for the improvement of mobile coverage across Africa?

Interviewee13: I think the current ideas are not fully tested and alternatives are actually difficult to imagine at this stage because if you implement such alternatives you run the risk of having academic alternatives (not tested), which would be an exercise that does not translate to a practical way of implementation. So I think we just have to be a bit more committed, we just have to consult more and think about the implementation of the existing models because I believe that the idea of cooperation is good. It just needs to translate into practice and the operators can pull it out. On the other hand, we need a bit more incentives from governments in terms of doing businesses i.e. incentivise the operators to invest more.

R: What about Zero Rating? Does this contribute to UAS and the improvement of mobile coverage in any way?

Interviewee13: I am happy that you have done your research so you have a good feel of some of the challenges the sector is facing. I will give you my perspective and the perspective of the business. So you are talking about OTT players, your Facebook,

your Skype, all these content that are created by institutions that God knows where they sit but they are delivering values that answers to customers specific needs. They are products that consumers love. It is a good example of what innovation can do. What they do is basically allow us to exchange experience, which is a natural need. Today you can even put me in your classroom, you can broadcast this conversation without me knowing, people can see what you do, when you do it, and where you are. This is really great and consumers like that. This is looking at it from consumers and innovation perspectives. When you look at it from a telecom landscape, there is a problem. We have operators like us who are spending millions of dollars to invest in infrastructures, on importation of handsets, to make sure that we have networks that are able to convey broadband signals; we work in acquiring customers and so on. Then you just have these applications that by-pass your systems and suddenly it is contributing to you losing revenues. By the way, let me just explain something to you. All these applications cannot work if there are no proper infrastructures like broadband. It is basically the combination of internet, broadband, smartphones penetrations, and other infrastructures that makes these applications work. Without these structures, such applications would never work. So, if now we have a situation where revenues that are already under pressure is even in the process of decreasing as a result of people using alternatives that do not give us the revenue that we are expecting, who is going to invest in the infrastructure? We are sitting in a position where we have 'operators' that are operating from an offshore perspective by providing the same services for which we paying license fees. We are sitting with a number of things that expects our obligations such as privacy, QoS, customer care etc. So we have a lot of obligation in our license conditions for which they are not subjected to. Another issue is that government today grant licenses in relation to certain ICT objectives like the creation of jobs, revenue generation for the country's budget, deployment of infrastructure to ensure accessibility across the country etc. Now when you have operators that you cannot even touch, it means government is losing as well as operators. Another element that is extremely important is security. Security today becomes a big issue and we have obligation in terms of ensuring that we provide security in partnership with governments like SIM card registration and Nigeria is a good example where a SIM card can be used by terrorist to blow-up a city. Now we need to know who that person is but those that are allowing phone calls to be made

from Moscow to London without traceability, how do we deal with that? If you look at terrorists today, they are using networks, they are using ICT platforms, they are using internet etc. to drive their propaganda, their hate speech. Who should be responsible for this? Now one of the purposes of licensing in general is to hold somebody accountable for the purpose of providing public services like telecoms. Now when you look at the challenges that the state face, we face as operators in losing revenues and the fact that consumers love the product, the question becomes: how do you make sure that government get its due, operators remain profitable and keep investing in infrastructure without which OTTs cannot operate and also drive innovation because you don't want to kill innovation and also look at issues surrounding security. There is a lot of thing that can go wrong even from the consumer's perspective in terms of privacy especially with the use of various apps. When you log on to say Facebook, do you know where your information is going? Do you really know what they are doing with all these information? And these OTTs are probably registered in tax havens where they do not pay taxes. Therefore, the business model is smartly designed but does it help the countries and the people in terms of the risk they facing. So the question is actually extremely complex and it is one that is yet to be resolved but we are saying as mobile operators: if you are going to provide the same services, you need to be subjected to the same obligations. Same services same obligations is our keywords. It seems to be a juicy situation for customers but they are exposed big time.

Now we effectively have a partnership with ***** (an OTT player)** but it does not mean that we agree on everything because social media drives usage and it increases data revenue. So from this perspective, we have an arrangement where without data you can access ***** (an OTT player)** and a lighter conversation but if you start downloading, then you have to pay for it. So it is an incentive for us to create value for customers but that does not mean that we are going to agree on the fact that we are going to allow people make phone calls for free on our networks? No. So we believe that the innovation is great but for many reasons including public interest reasons that are linked to lack of investments, tax, and security, OTTs would need to be regulated. The question becomes how do we do it? Do you push the government to make sure that OTTs create permanent establishments in countries so you can leverage and get tax from them? Do you block them like they have done in Dubai and other countries?

In the US there is what they call net neutrality and probably in Europe as well. Net neutrality is just a principle that enables freedom of expression in the context of telecoms. They are saying if you give a person data, it is an infringement on his freedom of expression to tell him how to use the data. That is effectively what net neutrality does. So the basis of net neutrality is freedom of expression because the word also in telecoms comes from the freedom of expression which includes freedom to impart information, which implies the means that you use to consume information, which is simply now done through broadcasting, telecoms services, infrastructures, and platforms. So regulation is basically, in an ideal democratic society, the limitations you have in that freedom of expression which needs to be guided by the principle of being reasonable and justifiable in a democratic society. So these are what this discussion should entail. Now the comment that I have for people who are pushing for net neutrality to stop Zero rating is that in every country you have freedom like a limitation to the extent that the limitation is justifiable, then in this case specifically, to the extent that OTTs should be regulated, I believe it is justifiable.

R: Are there any other comments you would like to make on the issue of uneven mobile coverage and UAS which you feel my questions have not covered or you wish to reemphasise?

Interviewee13: I think you are touching a very key issue and I like the fact that you have a banking background because banking is a highly regulated environment. So you have a regulated mind already and I think the issue that the issue you are touching is very important simply because connectivity is at the centre of development across the world. So your research would be extremely relevant. You just have to make sure that you are not all over the place and be much focused. I think the sector still needs skill because it has a lot of skills shortage issue. You are at the right place and I will encourage you to be really focused and produce a piece of work that would be directly consumed or used in the sector. Your research is very relevant as it is talking to the need of the market.

Appendix F: Informed consent form

Faculty of Business and Law

Informed Consent Form for research participants

Title of Study:	**Closing the digital divide in Africa: The role of mobile telecommunications and universal access and service policies**
Person(s) conducting the research:	Arakpogun Ogiemwonyi Emmanuel
Programme of study:	Doctor of Philosophy
Address of the researcher for correspondence:	Room 415 Newcastle Business School Northumbria University City Campus East Newcastle upon Tyne NE1 8ST United Kingdom
Telephone:	+447831705877
E-mail:	emmanuel.arakpogun@northumbria.ac.uk
Description of the broad nature of the research:	The study sets out to examine the liberalisation of the mobile telecommunications industry in Africa. From literature and the country analysis that has been carried out, it has been observed that despite the liberalisation and the existence of multiple GSM operators, mobile penetration in rural areas remains elusive. The problem is even more palpable in Eastern Africa. This study will attempt to investigate and understand the reasons behind this trend with a view to providing a stakeholder-based solution for improving mobile coverage in under-served locations in Africa. The researcher hopes to achieve this through qualitative research based on semi-structured interviews with top industry stakeholders (e.g. regulators, operators, civil society/industry commentators).
Description of the involvement expected of participants including the broad nature of questions to be answered or events to be observed or activities to be undertaken, and the expected time commitment:	Participants will be engaged with semi-structured interview questions which will be largely based on issues from literature and country-by-country analysis. Participants will be allowed to freely express themselves first within the boundaries of

	these questions and also share their experiences as it relates to the research problem. The anonymity of participants and organisations will be masked by using pseudo names except expressly stated otherwise by participants. Participation in this study is entirely voluntary and the participant may withdraw at any time. **Time commitment**: within 60 minutes.
Description of how the data you provide will be securely stored and/or destroyed upon completion of the project.	The data collected will be downloaded and stored unto the university software and secured with a password. Hard copies of transcripts generated in case of voice recorded interview will be locked in the university's cupboard. At the end of the study, the data will then be destroyed according to Newcastle Business School guidelines

Information obtained in this study, including this consent form, will be kept strictly confidential (i.e. will not be passed to others) and anonymous (i.e. individuals and organisations will not be identified *unless this is expressly excluded in the details given above*).

Data obtained through this research may be reproduced and published in a variety of forms and for a variety of audiences related to the broad nature of the research detailed above. It will not be used for purposes other than those outlined above without your permission.

Participation is entirely voluntary and participants may withdraw at any time.

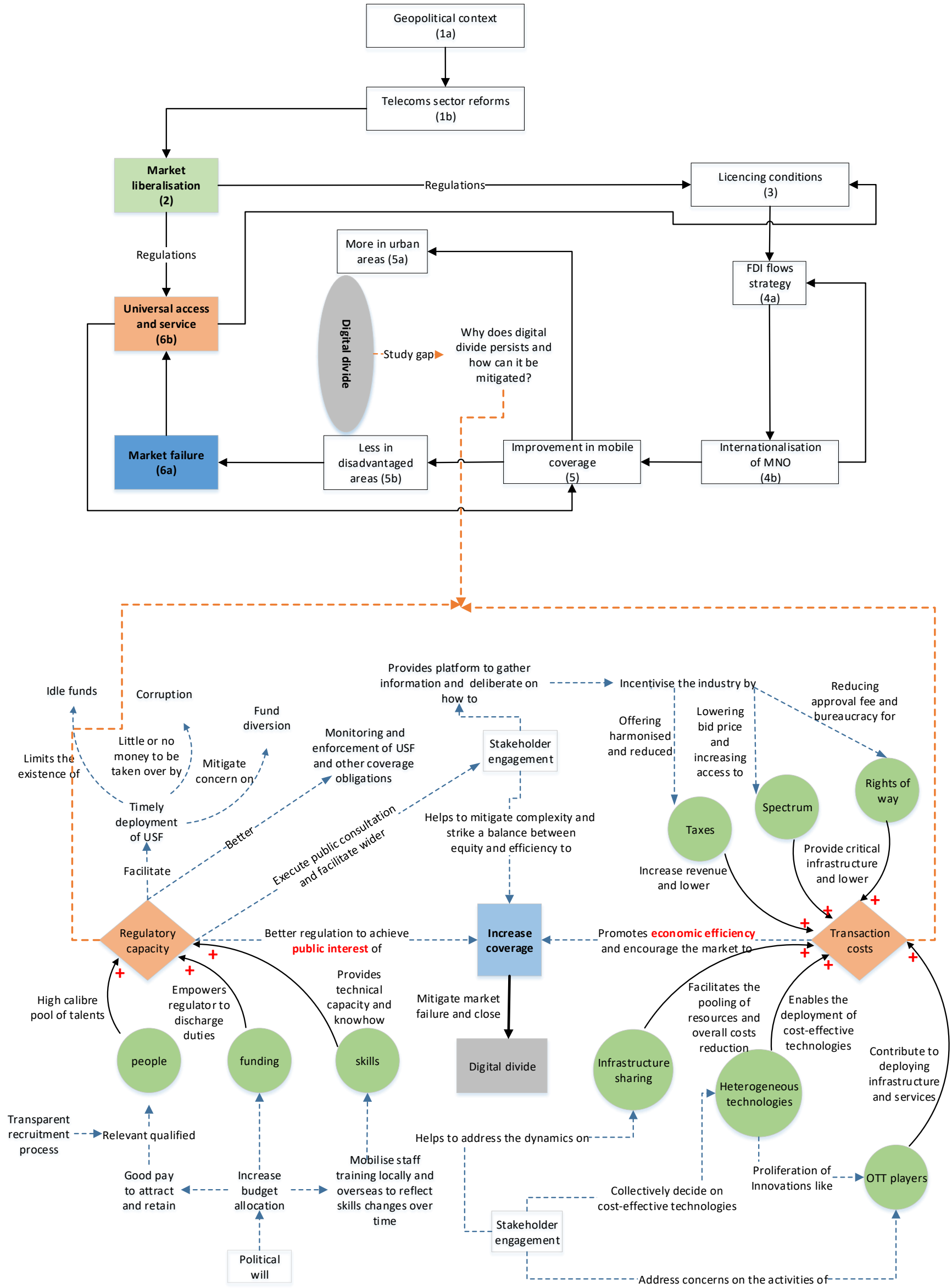
By signing this consent form, you are indicating that you fully understand the above information and agree to participate in this study on the basis of the above information.

Participant's signature: **Date:**

Student's signature: **Date:**

Please keep one copy of this form for your own records

Appendix G: Conceptual and empirical model combined



Appendix H: Examples of the regional classification of Eastern Africa

GSMA	Blycroft	African Union	UNICEF
Burundi			Burundi
		Comoros	Comoros
	Djibouti	Djibouti	Djibouti
Eritrea	Eritrea	Eritrea	Eritrea
Ethiopia	Ethiopia	Ethiopia	Ethiopia
Kenya	Kenya	Kenya	Kenya
	Madagascar	Madagascar	Madagascar
Malawi			Malawi
		Mauritius	Mauritius
	Mozambique		Mozambique
Rwanda		Rwanda	Rwanda
	Seychelles	Seychelles	Seychelles
	Somalia	Somalia	Somalia
South Sudan		South Sudan	South Sudan – since Sudan was split into [‘North’] Sudan and South Sudan in 2011
Tanzania	Tanzania	Tanzania	Tanzania
Uganda	Uganda	Uganda	Uganda
	Zambia		
	Zimbabwe		
9 countries	**12 countries**	**13 countries**	**16 countries**

Data sources: (AU, 2018; Blycroft, 2016; GSMA, 2017; UNICEF, 2008).

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