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Investigating cultural knowledge systems, Mandhwane and mind mobilisation for rural communities in the digital era

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ABSTRACT

Despite information and communication technologies for development (ICT4D)'s transformative contributions to society, scholars critique it for its technological determinism and Eurocentric bias, recommending holistic theories rooted in contextual ontologies and epistemologies. In response to these critiques, this study employed a mixed-method case study approach through a social constructivism methodology to investigate the research question; how do cultural knowledge systems facilitate the active and inclusive participation of African rural communities in digital transformation? Conducted from an emic Afrocentric paradigm, this investigation explored the research problem through cases of cultural preservation, financial management systems, and the farming practices of the Balobedu people in the Mamaila Tribal Authority (MTA), Limpopo Province, South Africa. The study found that identity, spirituality, Botho in adversity, Letšema collective capabilities, intergenerational learning, and the pedagogy of Mandhwane serve as the foundation for facilitating inclusive and active participation in digital transformation and, consequently, in the digital knowledge and learning economy. Additionally, the study found that, while the application of Botho philosophy to ICT4D has been valuable, its scope is limited and focuses primarily on the attributes of Botho, failing to express the holistic nature of human existence, which encompasses the NTU ways of being (Mu-NTU/Ba-NTU), temporal space and time (Ha-NTU), digital and non-digital resources (Ki-NTUs), and the quality and modality of being (Ku-NTU). This study argues that separating these entities lays a foundation for excluding rural communities in Africa in the digital era. This study significantly contributes to scholarly knowledge by introducing the Digital Mandhwane theory (DM-T), rooted in the entity of Batho encompassing NTU ways of being, knowing, doing, and leading and their interplay with environmental and psychological factors. The DM-T theorises the meaning of a transformative state of digital being, through human agency, in the context of the evolving digital knowledge and learning economy, advancing beyond ICT4D theory and technology dependency. While the findings are context-specific, the theoretical framework and methodological approaches developed in this study offer valuable insights that can be adapted to diverse cultural settings for future research on digital transformation. Researchers can draw insights to explore comparative analyses across diverse cultural contexts to examine the role of contextual cultural knowledge systems, practices, and processes in facilitating inclusive and active participation in digital transformation.

Keywords: entity, being, doing, knowing, leading, communal, NTU, Ubu-NTU, Botho, adversity, Mandhwane, power dynamics, Letšema, Batho, contextual, digital transformation, Afrocentric, ICT4D, ukweli, kujitoa, utulivu, uhaki, ujamaa

DECLARATION

I, Kgopotso Ditshego Magoro, declare that this thesis is my unaided work. It is submitted in fulfilment of the requirements for the degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university. Where I have used the efforts of others, I have acknowledged all the sources quoted.

Signature



December 2024

A LIBATION

This thesis is a dedication to the entirety of Batho, Modimo le Badimo. A libation to the African ancestors. The great innovators, technologists, and thinkers. The people who came before me, the people who are here and still to come. Dikolobe tša Bjatladi le Leote.[1] Vhathu vha Vho Mandzindzindzi. Le ditau tša Seoka.

Agee Kolobe wee!

Agee Lešitele le Semetsi le-wetša-madiba-a-kwena

Batho ba Bo Mafalo mafal'a ntlong.

Mokoto a fala ka Naka la pula e a na.

Batho ba ga Mmahlaka, le Mmaseepe sa go rema tlhaka le palelo.

Ke Batho ba ba boyago Bjatladi bja Mmamorela-a-Mahlatji bo-ana Kolobe.

Lena Batho ba bo Seferao le bo Ramoho. Batho ba bo Mapula Maepa le bo Modjadji Magoro.

Modjadji Mmaleakhobela la khobela o lala tsela.

Ke mosadi ga a na Marumo o Rema ka makonkwane.

Modjadji my Sun Goddess. Mmago ngwana o e tshweri thipa ka bogale.

Motswela Moila Mosela wa Pudi. Muthu wa vho Setete, vho Laupa Mthobeni, Nkutulane, le Masete.

Masingo a Ramabulana Vhathu vha Vho Mandzindzidzi a tsebe a di dwe, di dwa ka o ripiwa, ba re a re dwe re edwa ra re sepelane le yo re dwela le do boya le re botša.

Vhathu Vha vho Motumbu, Tshirembe wa mutshwu mulomo.

Vhathu vha boyaho Sanaka la Mmamorudi wa Tšhipi, Ahee Singo! Singo!

Vhathu vha vho Ramasoba, Lekholo Mamaila, lena vho Setete Magoro

E rini Singo! Singo!!!![2]

Ke sa lebale le lena Batho ba bo Mohale Motshekga.

---

[1] Ramafalo totemic ancestors and praise song.

[2] Magoro totemic ancestors and praise song.

Motho wa bo Moyahabo Kgatla le Mašepetla Motshekga.

Dikolobe tša Leote.

Lena vha Mutsika Mowoto Mutsiki wa Vathu.

Valozwi BakhalakaVhana vha Tjie Khalaka.

Vathu vha vho Bo Mafalo mafal'a ntlong, Mokoto a Fala ka Naka la pula e a na.[3]

Agee Kolobe wee!

[3] Motshekga totemic ancestors and praise song.

RUTANG BANA DITAOLA, LE SE YE LE TŠONA BADIMONG" (TRANSFER WISDOM, KNOWLEDGE AND SKILLS TO THE YOUNGER GENERATION) – AFRICAN PROVERB

I dedicate the Digital Mandhwane: Grounded in the entity of Batho to my children, Matete, Bophelo, and Moeletsi. Lena Ditau tša Seoka, Batho ba bo Mokgalabje Kwelekwele Mahlabaseletsi le Mokgekolo Moore Makgalanchenche. Batho ba bo Ntoamahlo le Tshehla, Serofo, Nchabeni, Tsuduka, Tsangwane, Ntakaneng le Ngwako Mahlabaseletsi. Not only did you endure all the sense and meaning-making conversations, but you also became active members of the Digital Mandhwane ecosystem. You co-created and shaped the narrative. Thank you for internalising the aspirations for the Digital Mandhwane. You understood the importance of healing both the visible and invisible wounds. I healed the wounds of Digital Mandhwane because you gave me the courage to do so.

Tsholofelo Magoro, Kamogelo Magoro, Karabo Selala, and Ditheto Sekhuta, thank you for giving Digital Mandhwane its identity. You make the futuristic aspirations of the Digital Mandhwane so real and close to home.

Mma Tshepo Khumbane, your spirit lives on. Your wishes are simple: Rutang Bana Ditaola, le se ye le tšona Badimong by socialising the African child through Mantlwa-ntlwane. Your teachings were about restoring Motho and healing the wounds of welfarism and the perpetual spirit of consumerism. I dedicate this work to you and the restoration of the entirety of Batho and the healing of our collective wounds.

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I extend my heartfelt gratitude to my mother Modjadji Magoro and my sisters Neo, Mapula, Basetsana, and Motswala Mpho Monyela. Thank you for tolerating my wounds. You epitomise the proverb Motho ke Motho ka Batho ba Bangwe. You understand that whatever happens to the individual happens to the rest of us. Ke a leboga!

To the community of Mamaila Kolobetona: indeed, it takes a village to raise a child. Thank you for giving life to the Digital Mandhwane. Ke a leboga Dikolobe.

I extend special thanks to my supervisor, Prof Luci Abrahams. Your teachings made this journey exciting, meaningful, and transformative. I am profoundly grateful. I am because you are.

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Finally, I would like to thank my employer, the National Treasury of South Africa, and my colleagues for their support and for making it possible for me to seek knowledge.

“We are each other’s harvest; we are each other’s business; we are each other’s magnitude and bond.” – Gwendolyn Brooks

RESEARCH DISSEMINATION: AUTHOR'S PUBLICATIONS AND PRESENTATIONS

Book chapter	Magoro, K. D., & Bidwell, N. J. (2022). Land, Letšema and Leola funeral scheme: Digital transformation on a rural community's own terms. In *Innovation practices for digital transformation in the Global South* (pp. 59–78). Springer. https://doi.org/10.1007/978-3-031-12825-7_4
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AfriLabs	AfriLabs. (2022, May 11). African innovation stories: A trilogy [Online]. *AfriLabs*. https://afrilabs.com

RESEARCH CONTRIBUTION TO THE COMMUNITY OF MAMAILA VILLAGE: ACTION RESEARCH VALUE-ADDED OUTPUTS

Dear Reader,

In 2017, upon commencing my PhD program, I came across an article authored by Hlokomelo Mabogale, a fellow resident of Mamaila village. In his article titled "*Coming from a rural area is like being cursed*[4]," Mabogale (2017) highlighted the challenges faced by learners in our community due to the absence of libraries, computer labs, and internet connectivity in schools, as well as the impact of digital illiteracy on rural children when they reach institutions of higher learning. Reading Hlokomelo's article resonated with me, as it reflected my experience. Like many rural children, I first touched a computer in 1996, at the age of 18 when I relocated to Johannesburg to pursue my tertiary studies.

Reading the article made me realise that 21 years later, the narrative for children in Mamaila remained unchanged. I reached out to Hlokomelo and other youths from Mamaila to explore the possibility of finding a solution. Consequently, I assumed the role of a facilitator because my PhD studies granted me access to individuals and institutions actively involved in bridging the digital divide. I leveraged my social capital within the digital transformation ecosystem to facilitate the deployment of the Mamaila Community Network (MCN) and the Mamaila Solar Community Hub (Tech Hub) illustrated in the collage below. The two projects were launched in 2022, respectively funded by ISOC and Computer Aid International. The contribution of this infrastructure is discussed in the case study published by ISOC[5]. Feedback from the community indicates that these projects have raised awareness of the importance of digital connectivity and digital skills, driving demand for the adoption and use of related services and products. I discuss reflexivity on my participation in these projects in Chapter 3.

[4] Originally published in 2017

[5] https://www.internetsociety.org/issues/community-networks/success-stories/mamaila/

x

Collage of PhD action-research value-added outputs



Note: Example of the tangible artefacts deployed in the community as the outcome of the PhD.

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LIST OF ABBREVIATIONS

AI	artificial intelligence
AU	African Union
CA	capability approach

CAPEX	capital expenditure
CAQDAS	computer-assisted qualitative data analysis software
CI	community informatics
CLIQ	community-based learning, ICTs and quality of life
CN	community networks
CoP	communities of practice
CKSPPs	cultural knowledge systems, practices and processes
CTA	constructive technology assessment
DCDT	Department of Communications and Digital Technologies
DDIV	Digital Mandhwane imagined village
DMMA	Digital Mandhwane methodological approach
DM-T	Digital Mandhwane theory
DPME	Department of Planning, Monitoring and Evaluation
DPI	digital public infrastructure
DT	digital transformation
DTPS	Department of Telecommunications and Postal Services
DKE	digital knowledge economy
DX4D	digital transformation for development
FLOW	Fostering Local Wellbeing
GBV	gender-based violence
GDP	gross domestic product
HCI4D	human-computer interaction for development
HCI	human-computer interaction
ICT4D	information and communication technologies for development

IDRC	International Development Research Centre
IK	indigenous knowledge
IKS	indigenous knowledge systems
ISOC	Internet society
IoT	internet of things
ILO	International Labour Organisation
IS	information systems
ISAD	Information Society and Development
ITU	International Telecommunication Union
IP	intellectual property
KE	knowledge economy
MICT SETA	Media, Information and Communication Technologies Sector Education and Training Authority
MTA	Mamaila Tribal Authority
NDP	National Development Plan
NEMISA	National Electronic Media Institute of South Africa
NICP	National Information and Communication Program
NIP	National Infrastructure Plan
NLP	natural language models
NGO	non-governmental organisation
MCN	Mamaila Community Network
OPEX	operating expenditure
PC4IR	Presidential Commission on the Fourth Industrial Revolution
PNC	Presidential National Commission on Information Society and Development
PRA	participatory rural appraisal

PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
CLIQ	community-based learning, ICTs and quality of life
RDP	Reconstruction and Development Programme
RIA	Research ICT Africa
RLL	rural Living Lab
SLF	sustainable livelihood framework
SLL	Siyakhula Living Lab
StatsSA	Statistics South Africa
TAM	technology adoption models
UNCTAD	UN Trade and Development
UNDP	United Nations Development Programme
UTAUT	unified theory of acceptance and use of technology
WSIS	World Summit on the Information Society

CHAPTER 1 :INTRODUCTION AND RESEARCH SIGNIFICANCE FOR CONTEXTUAL DIGITAL TRANSFORMATION (DT)

1.1 Introduction

In this chapter, I discuss the research problem statement, research questions, study limitations, and background information to contextualise the relevance and significance of this study. I start the section by reflecting on the issues from my master's research [6]and my subsequent critical discourse with leading information and communication technologies for development (ICT4D) scholars to contextualise why I decided to investigate the role of cultural knowledge systems, Mandhwane and mind mobilisation for rural communities in the digital era.

The rapid advancements of digital technologies and applications have significantly improved access to essential services such as health, education, government e-services, agriculture, and financial inclusion. However, communities in resource-constrained environments and on the periphery of the information superhighways remain excluded from accessing these essential services and opportunities. This exclusion exacerbates existing inequalities and injustices, further widening the gap between privileged and marginalised communities. In response to these disparities, I decided to embark on this study to explore issues related to the digital divide in rural areas, drawing on insights from my master's research, which examined the challenges of rural connectivity in Limpopo province, South Africa.

During my master's research, I identified several challenges, including insufficient integrated planning, limited community engagement, institutional capacity constraints, and a lack of clear roles and responsibilities, highlighting the need for a holistic approach to bridging the digital divide. Drawing insights from ICT4D scholars, I developed a conceptual dual and holistic model advocating for stakeholder collaboration at the macro, meso, and micro levels to achieve what I framed as Beyond access: Connectivity processing, and purposeful consumption for socio-economic change (Alampay, 2006; Gigler, 2011; Gurstein, 2007; Heeks, 2009; Stillman & Linger, 2009). After graduating in 2014, I reflected on the conceptual model and how it could be applied in a real-life context, particularly, as I contemplated pursuing a PhD.

1.1.2 A critical discourse with the ICT4D experts

In 2016, my journey of reflection led me to join an online global community of academics in Community Informatics (CI) and related fields like ICT4D, facilitated through a mailing list that the late Dr. Michael Gurstein managed. My journey took an unexpected turn when I posed questions to the group about the theoretical underpinnings of ICT4D. In retrospect, what now reads like a naive inquiry exposed my limited scholarly depth (see Appendix A). Nevertheless, despite my novice inquiry, I received responses from leading ICT4D scholars who recommended peer-reviewed literature to help me close my knowledge gaps, while others took their time to clarify the concepts that

[6] https://wiredspace.wits.ac.za/items/6f8397df-4227-4627-8a71-d9161201aab7

were unclear to me. Some responses to my question highlighted the collision of worldviews and the imposition of Western ideologies as challenges leading to theoretical gaps in ICT4D and CI, which encouraged me to seek answers from my positionality as an African.

A paper that significantly broadened my perspective on the theoretical underpinnings of ICT4D was by Andersson and Hatakka (2013), titled *What are we doing? Theories used in ICT4D*. The paper helped me see the ICT4D field as a dynamic interplay of diverse theories and practical challenges. The paper further encouraged scholars to engage in critical reflection on the practical implications of ICT4D research, highlighting gaps and inconsistencies in theory application and the challenges in establishing a clear link between ICTs and development outcomes.

The article, together with the discourse with experts was a privilege and a moment of scholarly awakening and empowerment. However, this experience also left me with more questions than answers. One of the main issues that emerged from this reflection was my concern about the categorisation of ICT4D as "international development." I believed this framing disconnected the field from local contexts and implied a sense of superiority, promoting a top-down approach in which development is envisioned for communities that are not even part of the discourse. This dilemma, coupled with the clash of worldviews, motivated me to explore the literature on ICT4D and worldviews (Krauss, 2018; Myers & Klein, 2011; Ishemo, 2004; Srinivasan, 2013; van Stam, 2012).

1.1.3 Closing the knowledge gaps

A few months after engaging in critical discourse with the ICT4D experts, I resolved to continue reading literature exploring the intersections of ICT4D with worldviews, values, and culture. I came across Prof. Twinomurinzi's (2010) PhD thesis titled: *Facilitating policy implementation using ICT in a development context: A South African Ubuntu approach*. In an attempt to close my knowledge gaps, I reached out to Prof Twinomurinzi because I found resonance with his perspective on Ubuntu, potentially offering an angle for my PhD. To aid in my theoretical dilemma and struggles with the concept of "international development," Prof. Twinomurinzi emphasised that both community (micro) and international (macro) perspectives are needed in development initiatives. However, the macro-level approach often overlooks the micro-level perspectives, while bottom-up approaches struggle to scale up effectively. He further expressed his concern about the erosion of Ubuntu among the urban younger generation due to the consumption of Western content. The conversation sparked a keen interest in me regarding the interplay between the macro, meso, and micro levels and the pivotal role of cultural values within ICT4D.

1.1.4 Finding the path

After engaging with the experts, I gained valuable insights into the complexities of ICT4D initiatives and the importance of critically assessing the values embedded in digital technologies and how people's worldviews shape the ecosystem. The engagements shaped my research focus and motivated me to embark on this interdisciplinary study. I adopted an emic Afrocentric and social constructivist approach to explore the role of cultural knowledge

systems, Mandhwane (learning by doing), and mind mobilisation for rural communities in the digital era to better understand participation in the digital knowledge economy (DKE). The methodological approach of this study is underpinned by the Afrocentric paradigm, grounded on the legitimacy of the African thought system of holism and collectivism, which recognises the mythology, cosmology, belief systems, cultural reality, and values of African people as legitimate (Armstrong, 2005; Chawane, 2016; Monteiro-Ferreira, 2009).

1.2 Research problem statement

The problem addressed in this study is the deterministic approaches within ICT4D and the limited exploration of context-specific ontologies and epistemologies beyond **Ubuntu attributes**. These deterministic approaches, coupled with an over-reliance on dominant indigenisation theories like Ubuntu, fall short of unlocking the collective human capabilities needed to drive inclusive DT in rural African communities. While Ubuntu offers valuable communal values, it is limited in its ability to account for the varied ontologies, epistemologies, and socio-cultural contexts across different African communities. Consequently, this inadequacy leads to the implementation of digital skills interventions that often promote individualism and the consumption of digital products and services, with little focus on unlocking contextual digital innovations. Additionally, the lack of appropriate digital infrastructure to enable contextual digital solutions exacerbates the problem, leading to the low uptake and usage of digital resources. Digital leaders who view communities as passive beneficiaries, without acknowledging their agency, perpetuate power dynamics and exclude local ontologies and epistemologies. This gap highlights the lack of practical integration of context-specific cultural knowledge systems into ICT4D initiatives.

1.3 Objectives and significance of the study

This study aims to generate an African-inspired theory that advances context-specific ontologies and epistemologies in DT within resource-constrained environments. Its significance lies in providing a holistic, emic Afrocentric exploration of how contextual and culturally embedded knowledge systems can unlock collective human capabilities, facilitating the active and inclusive participation of African rural communities in the digital era. Moreover, the significance of the study is in the exploration of the intersection of culturally embedded knowledge systems and digital skills development, the adoption and usage of digital technologies, and the role of appropriate digital infrastructure and digital leadership in facilitating a people-centered and digitally connected transformation. These dimensions collectively provide a holistic approach to exploring the research questions below.

1.4 Research questions

The main research question explored in this study is: How do cultural knowledge systems facilitate the active and inclusive participation of African rural communities in DT? The main research question comprises five sub-questions that concern the various components of the research analytical framework illustrated in Figure 1.1 (discussed in detail in **section- 2.3).**

> **Sub-question 1**: How do deeply embedded cultural practices unlock collective human capabilities for rural DT?

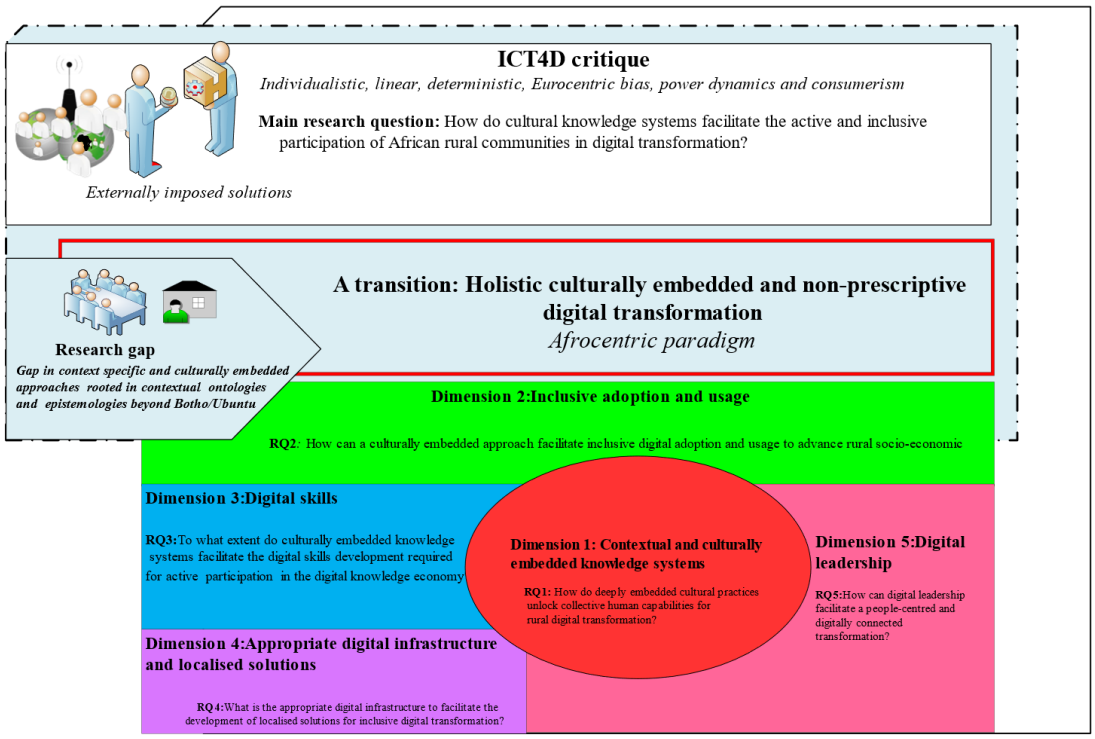
Sub-question 2: How can a culturally embedded approach facilitate inclusive digital adoption and usage to advance rural socio-economic aspirations?

Sub-question 3: To what extent do culturally embedded knowledge systems facilitate the digital skills development required for active participation in the DKE?

Sub-question 4: What is the appropriate digital infrastructure to facilitate the development of localised solutions for inclusive DT?

Sub-question 5: How can digital leadership facilitate a people-centred and digitally connected transformation?

Figure 1-1: Research analytical framework (adapted from Hanna, 2018)



Note: This figure illustrates the dimensions of the research analytical framework and research questions.

1.5 Limitations of the study

This study faced several limitations, including constraints on resources and challenges related to the COVID-19 pandemic. These issues impacted data collection, particularly the household survey, which had a low response rate, and the prototype testing workshop, where technological literacy and access to smartphones were barriers. Mitigation strategies were implemented, such as adjusting the workshop format to facilitate intergenerational engagement and relying on alternative data sources to complement the survey findings. A more detailed discussion of these limitations

and the strategies used to address them can be found in the methodology section.

1.6 Background to the study: Contextualising ICT4D and African DT narratives

1.6.1 Contextualisation of ICT4D in South Africa: Brief historical perspectives

Reflecting on the evolution of South Africa's DT ecosystem is crucial for exploring the research problem in this study. The reflection allows for understanding the ideological and sociological factors that have shaped the South African ecosystem and the digital divide in resource-constrained environments. This understanding is essential for exploring challenges and opportunities for integrating cultural knowledge systems into digital initiatives. Historically, South Africa faced the dual challenge of closing the digital divide while navigating the transition from apartheid to a democratic government. The White Paper on Reconstruction and Development Programme (RDP) states that "South Africa's economy is characterised by extremely unequal distribution of resources. Therefore, technology policy must address this duality and must also address the development of both indigenous and exogenous science and technology, to meet the challenges of South Africa's people" (RSA, 1994, p.28).

Additionally, South Africa had to play catch-up with global recommendations such as the International Telecommunication Union (ITU)'s Maitland Commission, and the Missing Link Report (ITU, 1985). The Maitland Commission addressed specific issues such as recommending methods to stimulate telecommunications development in the developing world and advocating for the use of appropriate and proven technologies to serve the interests of all stakeholders. Furthermore, it aimed to achieve progressive self-reliance in developing countries and narrow the gap between developed and developing nations. Additionally, the Commission anticipated that improving and expanding networks in developing countries would create a significant market for telecommunications equipment, leading to increased world traffic and information flows, and subsequently fostering opportunities for commerce. Moreover, it envisioned that expanded telecommunication networks would contribute to global betterment and enhanced safety. As the digital landscape evolved, the World Summit on the Information Society (WSIS), held in 2003 in Geneva and 2005 in Tunis, became a pivotal platform for world leaders to forge a collective way forward on the role of ICTs in development (ITU, 2003).

Building on these foundational recommendations by the ITU, the 2024 Global Digital Compact reflects the evolution of international cooperation in the digital era. It aims to address the challenges and opportunities of the rapidly transforming digital landscape by leveraging digital technologies to achieve the SDGs. The digital public infrastructure (DPI) is one of the key components of the Global Digital Compact framework, serving as an enabler of inclusive digital transformation by ensuring systems are secure, interoperable, and tailored to meet diverse local needs while advancing global sustainable development. The Compact also prioritises universal connectivity, digital skills development, human rights, internet governance, digital trust and safety, information integrity, data privacy and security, and the exchange and use of data for the achievement of the SDGs, all of which are essential to creating an equitable and resilient digital future (United Nations, 2024).

In reflecting on these global frameworks, it becomes evident how they are interconnected with the historical and

ongoing efforts to shape DT and the knowledge economy (KE) in developing countries. For example, International organisations like the International Development Research Centre (IDRC) played a pivotal role in shaping the pathway for utilising information and communication technologies to advance reconstruction and development goals as South Africa grappled with the socio-economic challenges of transitioning from apartheid to democracy. Notably, the IDRC prides itself on its influence, framed as "ICTs come to the Rainbow Nation: Information technology as tools for development in South Africa" (IDRC, 2023).

One of the significant contributions by the IDRC was the establishment of the National Information and Communication Program (NICP) in 1997 to advise and assist the government in conceptualising, designing, and implementing information programs, systems, and policies in alignment with the development goals for the new government (IDRC, 2023). Furthermore, the IDRC enabled the establishment of multipurpose telecentres and projects such as SchoolNet SA. These initiatives laid the foundation for South Africa's DT journey. Building on the NICP foundation, the Presidential National Commission on Information Society and Development (PNC) was established in 2001 to advise the Presidency on leveraging ICTs to address South Africa's development challenges and enhance global competitiveness. The PNC led to the introduction of the development of the 2007 National Information Society and Development (ISAD) plan. ISAD aimed to create South Africa as an advanced information society in which information and ICT tools are key drivers of economic and societal development (Magoro, 2015). Despite the failure to achieve the objectives outlined in the ISAD plan, South Africa remained optimistic about the role of access to information and ICTs in building an inclusive society.

In 2012, the National Development Plan (NDP) outlined South Africa's vision for "a seamless information infrastructure by 2030 that will underpin a dynamic and connected vibrant information society and a KE that is more inclusive, equitable and prosperous" (Presidency, 2012, p. 45). The NDP paved the way for a new path grounded on a holistic understanding of the role of ICTs in driving inclusive growth and development through the introduction of various targeted policy reforms. One such reform is the 2013 Broadband policy , among other policies and strategies implemented to facilitate the growth and inclusive development of South Africa's ICT sector as shown in Table 1.1 (Partridge et al., 2024).

Table 1.1: South African ICT sector-specific policies and strategies

Policy	Year	Objective
eHealth Strategy South Africa	2012	Improve healthcare service delivery through digital health systems, health information exchange, and digital health skills development
National Cybersecurity Policy Framework	2015	Elevate cybersecurity in South Africa's cyberspace
National e-Strategy	2017	Enhance public service delivery and economic growth through effective ICT regulation
First National Integrated ICT Policy White Paper	2016	Promote a more inclusive and equitable information society through digital infrastructure, technology adoption, and skills development

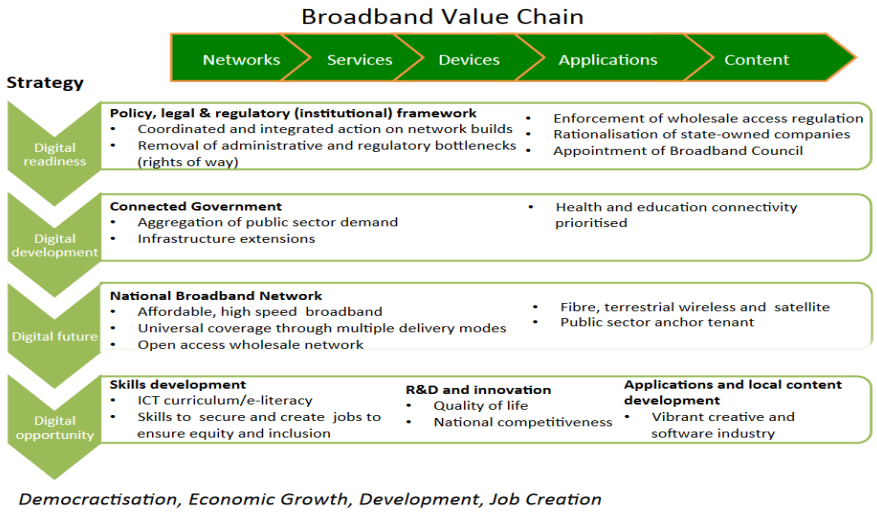
ICT Small and Medium Enterprises Support Strategy	2017	Promote growth and development of small and medium-sized ICT enterprises
Presidential Commission on the 4th IR Strategy	2019	Devise a comprehensive national policy to harness the transformative potential of the 4th Industrial Revolution

Note: This table showcases some of the South African ICT sector-specific policies and strategies identified by (Partridge et al., 2024).

1.6.2 South African aspirations

Aligned with the NDP 2030 vision, the Broadband policy aimed to provide 100 per cent of the population with access to broadband services by 2020. The four-pronged strategy and the broadband value chain illustrated in Figure 1.2 align with the ITU's recommendation for holistic approaches. Importantly, the Broadband policy predates the ITU's 2021 holistic perspective, indicating that South Africa has been proactive in conceptualising an integrated approach to bridging the digital divide.

Figure 1-2: SA Connect strategy and value chain



Note: From DCDT, 2013, Figure 8.23.

Moving beyond conceptual frameworks and the NDP aspirations, the section below provides an overview of the practical steps by the South African government to implement its Broadband policy . The section is structured according to the dimensions of the research problem and aligned with the research analytical framework for this study. This overview is significant for understanding and exploring the research problem as it sheds light on the specific actions taken by the government to address the digital divide in resource-constrained environments.

a Cultural heritage

The NDP emphasises the role of culture and ICTs in the economy. Moreover, the national e-skills plan of action highlights the challenges of supply-focused interventions and recommends that "South Africa should harness technology in ways that valorise the country's culture, independence, social identity, socio-economic prosperity,

innovation, creativity, employment opportunities, global competitiveness, and continental position. To achieve this, a sound approach to the social appropriation of ICT for local benefit is required" (DOC, 2013,p.43). Section 14 of the Broadband policy highlights areas that could be digitised to create economic opportunities while preserving cultural content. The policy acknowledges the role of local content as a stimulator for digital economies and refers to the need for the localisation of local content and application development (DCDT,2013).

In addition, the report of the Presidential Commission on the Fourth Industrial Revolution (PC4IR) acknowledges the role of culture in developing future jobs required in the Fourth Industrial Revolution (4IR) and the creative economy sector. The report further highlights that "the need for social scientists will increase as there is a requirement to navigate complex human issues of ethics, wellbeing, identity, et cetra. in this new era of cyber-physical integration as it impacts and shapes our culture" (Presidency, 2020, p. 114). Section 10.6.3 of the National Integrated ICT Policy White Paper highlights the role played by language in building an inclusive DT transformation ecosystem and the need to provide content that responds to or addresses people's developmental needs. These insights suggest that, in the context of South Africa, integrating cultural practices into ICT development is a necessary step to ensure that technological growth aligns with the country's cultural identity, addresses socio-economic needs, and creates tangible opportunities for local communities.

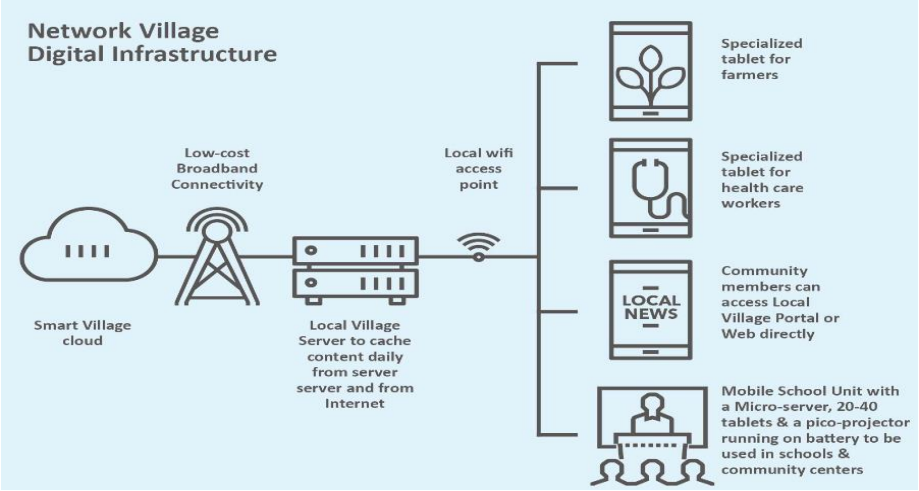
b Inclusive digital adoption and use

Across the globe, the use of ICTs is connected with accelerating advancements toward achieving the SDGs and enhancing the quality of life for individuals in significant ways (ITU, 2024). The ITU advocates for the implementation of smart villages in response to the SDG. According to the ITU,

> "Smart villages develop smart solutions to deal with challenges in their local context. They build on existing local strengths and opportunities to engage in a process of sustainable development of their territories. They rely on a participatory approach to develop and implement their strategies to improve their economic, social, and environmental conditions, in particular by promoting innovation and mobilising solutions offered by digital technologies [..]" (ITU, 2020, p2).

A smart village embraces DT across key sectors to enhance the lives of its citizens as illustrated in Figure 1.83 supported by network village digital infrastructure. The ITU, suggests that for all citizens to have access to SDG-related services, low cost affordable and sustainable digital infrastructure is required.

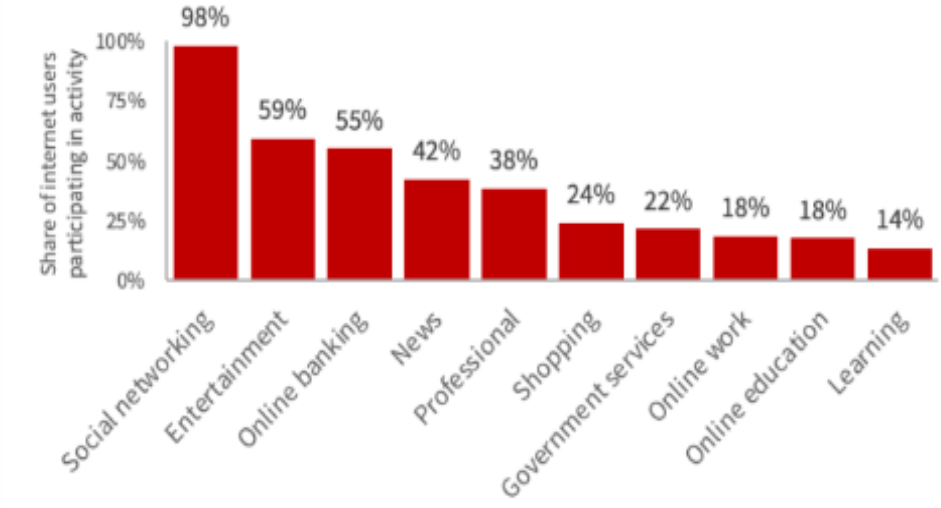
Figure 1-3: ITU proposed a digital infrastructure model



Note: This figure illustrates an example of a potential digital infrastructure model that could support a connected smart village. ITU, Figure 7.

In the context of South Africa, the Broadband policy states that digital inclusion extends beyond the rollout of the network and is in many ways dependent on the availability of relevant content for local users. Furthermore, content carried across broadband networks is the crux of the KE and information society. The policy proclaims that without relevant content related strategies, the government is unlikely to succeed and targets relating to economic growth and employment will not be reached. This is echoed in the implementation programme guide for the National Digital and Future Skills strategy of South Africa 2021–2025 recognises that access to the Internet and digital technologies alone do not guarantee citizens' productive use of these technologies (DCDT, 2021). Moreover, despite achieving high access levels, "the Internet is primarily used for social and entertainment purposes rather than for economic activity" as illustrated in Figure 1.4 (Partridge et al., 2024, p. 15).

Figure 1-4: Internet usage in South Africa



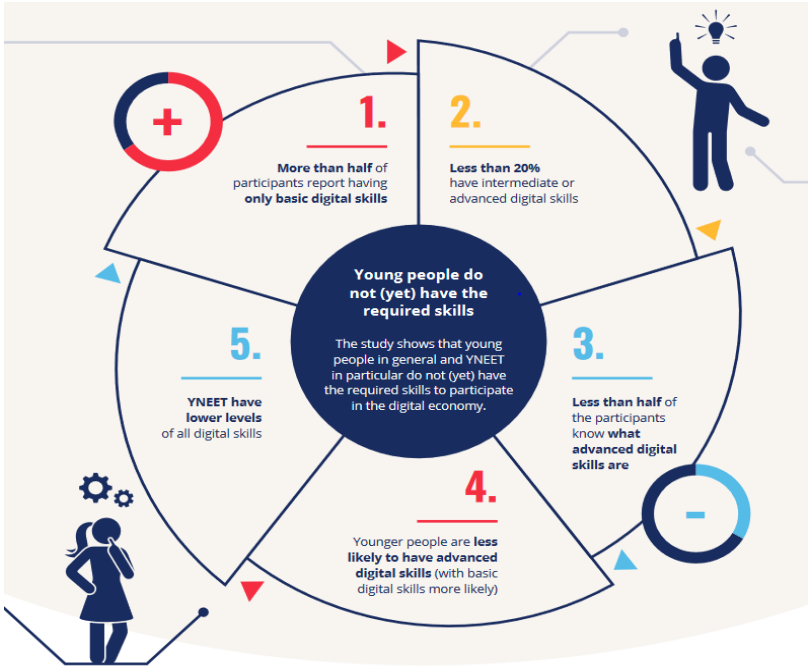
Note: From Research ICT Africa, 2022.

The findings by Partridge et al. (2024) are supported by Kemp (2024), illustrating that there were 45.34 million internet users in South Africa at the start of 2024, with internet penetration reaching 74.7 percent. 25.90 million users aged 18 and above were using social media in South Africa at the start of 2024, highlighting that while internet access has expanded significantly, its use is not yet fully aligned with economic development goals or the broader digital economy.

c Digital skills

The National Digital and Future Skills strategy highlights the need for mechanisms to foster digital skills development across South Africa, at early childhood development, schooling, and post-school education and training levels, recognising that digital skills are necessary for economic growth, social development and cultural enrichment across all sectors of our society and economy. One notable example of efforts to advance these goals is NEMISA's Ya Rona Digital Programme. The programme has been instrumental in empowering and upskilling communities in basic digital literacy (NEMISA, 2020). Moreover, NEMISA's Co-Labs, strategically located within higher education institutions across the country serve as vital hubs for advancing from basic to more advanced digital skills. In line with this push for digital skills development, South Africans have shown the highest proficiency in ICT familiarity, with an average score of 82%, followed by data literacy, at 79% (Partridge et al.,2024). However, there is a notable gap in security awareness, with South Africans scoring the lowest in this category, averaging 66%. As highlighted by the Department of Planning, Monitoring and Evaluation (DPME) (2024), cyber-attacks and hacks have become a significant challenge, highlighting a greater need for cybersecurity capability. Partridge et al.(2024) observed that in South Africa, individuals with higher levels of education generally exhibited higher proficiency in digital skills. Moreover, age, location, and gender play significant roles in shaping digital literacy, with younger cohorts, urban residents, and males typically demonstrating higher levels of proficiency. This demographic divide underscores the challenge of ensuring that all segments of the population are adequately equipped with the necessary digital skills. For instance, the International Labour Organisation (ILO,2023), highlights that young people, in general youth not yet in employment, education, or training in particular, do not (yet) have the required skills to participate in the digital economy, as summarised in Figure 1.5. This skills gap poses a significant barrier to achieving the broader goals of South Africa's NDP 2030 vision.

Figure 1-5: Young people with digital skills



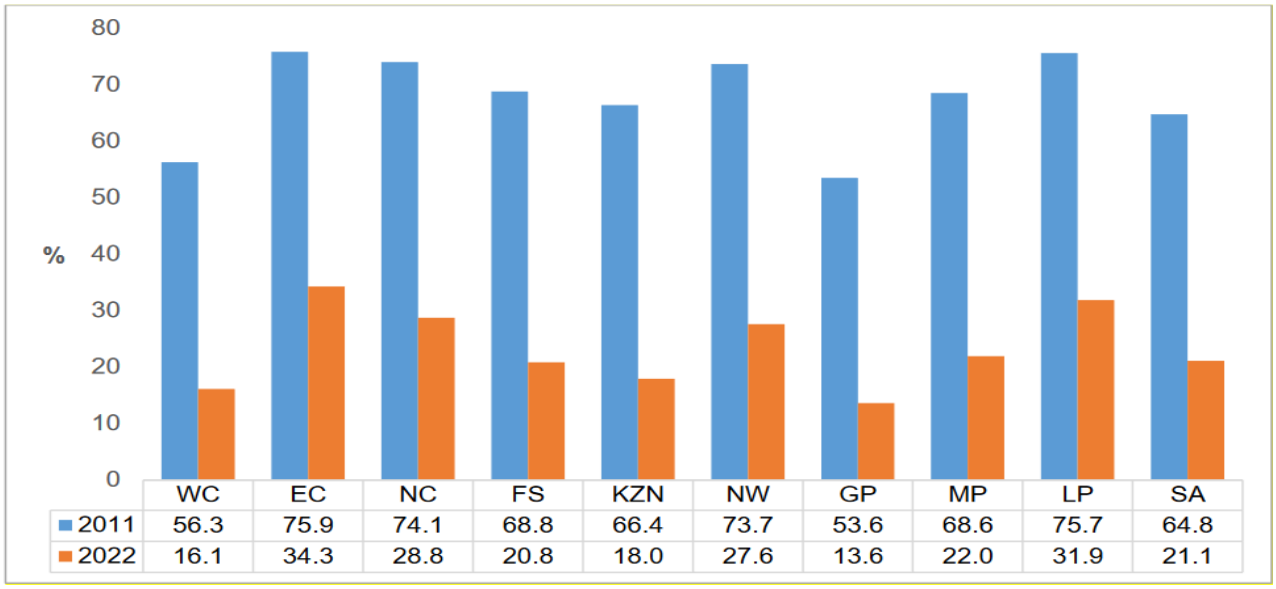
Note: From ILO (2023).

d Infrastructure

Principle Two of the Geneva Declaration emphasised that information and communication infrastructure is essential for an inclusive information society (ITU, 2003). Consequently, for countries aspiring to build an inclusive information society, it became clear that developing policies and creating enabling environments to encourage investments in telecommunications infrastructure is crucial. South Africa's Broadband policy aimed to connect 100% of the population with broadband services by 2020. However, this target was not met. Despite this, the government has allocated R3 billion for the 2023/24 and 2024/25 fiscal years to continue advancing phase 2 of the project (Magoro et al., 2023).

While the original goal remains unachieved, recent data from Statistics South Africa shows significant progress. Between 2011 and 2022, the percentage of households without Internet access decreased substantially, from 64.8% in 2011 to just 21.1% in 2022 (Statistics South Africa, 2022). There has been a significant decrease in the number of households without access to the Internet in the Eastern Cape (34.3 per cent) and Limpopo (31.9 per cent) in 2022, compared to 75.9 per cent and 75.7 per cent in 2011, respectively. This decline demonstrates ongoing efforts and highlights the positive steps taken towards improving broadband access across the country. Moreover, households in the Western Cape and Gauteng enjoy greater access. Figure 1.6 illustrates the significant decrease in households without Internet access in 2022, compared to 2011.

Figure 1-6: Percentage of households without access to the Internet at home by province, 2022



Note: From Stats SA, Census 2022, Figure 8.23.

Regardless of the significant improvement in broadband access, the National Infrastructure Plan (NIP) 2050 highlights that "while there is excellent broadband availability across the country, it is not easily accessible to most households in a way that would indicate meaningful digital connectivity" (Department of Public Works and Infrastructure, 2022, p. 45). The NIP highlights that South Africa performs poorly in global indices on demand side for Internet use, skills, and digital awareness. South Africa's overall ICT infrastructure has improved from a ranking of 86 in 2014 to 70 in 2023 (DPME, 204).

However, despite these improvements in global rankings, as noted by Partridge et al. (2024), significant challenges persist in internet inclusivity, particularly concerning availability and affordability. Genesis Analytics (2023) highlights that despite concerted efforts to improve digital access in South Africa, significant hurdles remain. The unequal distribution of electricity access, which heavily favours urban regions, leaves rural communities often lower income without the reliable power necessary for digital connectivity. Furthermore, while there are improvements in fixed-line coverage, geographic disparities persist, limiting digital participation outside urban centers. In cases where there is infrastructure, theft, vandalism and loadshedding cause major disruptions affecting network infrastructure, downtime, disconnection and slowing internet speed. Moreover, South Africa is lagging behind key international comparators concerning download and upload speed and data costs. (DPME, 2024). However, Kemp (2024) reports that, despite these infrastructure challenges, there have been notable improvements in internet speeds, with median mobile internet speeds rising by 35.4% and fixed-line speeds increasing by 13.6% compared to 2023.

To address these ongoing challenges, regulatory reforms have been introduced since 2013 to transform the ICT sector and enable the implementation of the Broadband policy (Partridge et al., 2024). The Broadband policy highlights that rural populations and underserved areas remain poorly served by network infrastructure and services. In line with these efforts, the National Integrated ICT Policy White Paper 2016 emphasises the importance of using spectrum

efficiently to maximise its value for South Africans by supporting sustainable economic, social, and cultural development (DTPS, 2016, p. 43). Despite these efforts, South Africa continues to face significant challenges in closing the digital divide, particularly in rural and underserved areas. To address this gap, one solution being explored is the deployment of Community Networks (CN), which are increasingly seen as a key strategy. This approach is further reinforced by the Next Generation Radio Frequency Spectrum Policy and Electronic Communications Amendment Bill of 2023, which considers community networks as one of the strategies for closing the digital divide (DCDT, 2023).

The ongoing efforts to improve broadband access and bridge the digital divide in South Africa highlight the need for innovative solutions that not only expand connectivity but also foster digital skills and local innovation through dual approaches, both in terms of physical infrastructure and virtual platforms. In this regard, tech hubs are crucial, as they provide not only physical and virtual spaces for learning but also act as incubators for the development of digital applications and content across various sectors. While these hubs are instrumental in driving innovation, their concentration in urban areas, with limited presence in rural regions, reflects the broader infrastructure gaps that continue to hinder equitable digital access across South Africa (Abrahams, 2020; Briter Bridges, 2023).

However, the realisation of this vision and the associated aspirations face significant challenges. The DPME (2024) highlights that critical areas, such as leadership, institutional arrangements, and coordination among state actors, still need considerable attention. Fragmented planning, limited competition, capacity constraints, and the lack of adequate digital education output have hindered efforts to harmonise the sector and fully achieve these goals. Moreover, the PC4IR (2020) points to the domination of multinational companies within South Africa's ecosystem, which obstructs localisation efforts and further exacerbates inequalities in digital access and use. Partridge et al. (2024, p. 3) argue that "despite an emphasis on ICTs for development in South Africa over the past thirty years since its democratic transition, policies have fallen short in fostering inclusive digitalisation. Severe structural inequalities are still hindering socioeconomic mobility, and these inequalities are reflected in the extent and use of digital technologies by different population segments."

e Leadership

The infrastructure, meaningful connectivity, uptake and usage as well as digital skills challenges discussed in the previous sections underline the critical role of leadership in bridging the gap between South Africa's digital aspirations and the realities of implementation. The gap between vision and progress emphasises the need for a more coordinated, comprehensive approach to digital transformation. In this regard, the ITU asserts that while connectivity is essential, optimal delivery requires more than infrastructure alone—it requires strong leadership, political will, and the mobilisation of multi-stakeholder partnerships. According to the ITU, "for DT to be effective, there is a need to shift from traditional technology-centric, siloed, supply-side approaches to demand-driven needs. It further requires governments to show leadership and political will by departing radically from territorial, silo behaviour, and [to] adopt an integrated, cross-ministerial, cross-sectoral, whole-of-government approach to planning and implementation" (ITU, 2020).

The holistic approach advocated by the ITU is further supported by the UNDP's DT framework, which emphasises the interconnectedness of DPI, governance, connectivity, and people, as illustrated in Figure 1.7. The framework guides the assessment, planning, and implementation of digital initiatives, helping to evaluate a country's digital strengths and weaknesses and inform the development of national digital strategies.

Figure 1-7: UNDP's DT framework

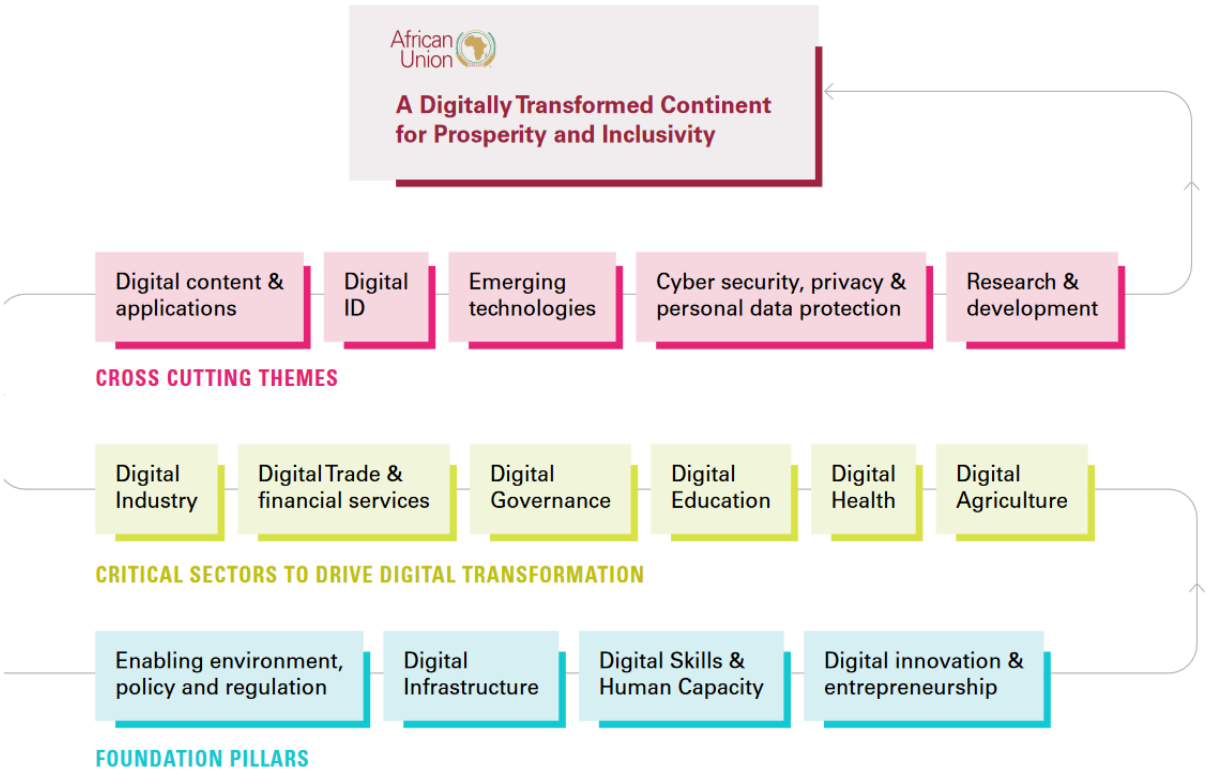


Note: The UNDP's DT framework illustrates the various principles and elements of inclusive digital transformation, organised around the central concept of DPI, 2023, p. 5.

While the ITU stresses the importance of a holistic, demand-driven approach to digital transformation at the national level, the African Union (AU) takes a broader, continent-wide perspective. The AU's DT strategy aims to foster a society, economy, and public administration that actively embraces digital technologies, thereby enhancing the quality of life for individuals and society (African Union, 2020). Aligned with the ITU and the UNDP's views on the integrated and holistic approach, the AU strategy is built upon foundation pillars such as enabling environment, policy and regulation, digital infrastructure, digital skills and human capacity, digital innovation, and entrepreneurship. It also identifies critical sectors including digital industry, digital trade and financial services, digital government, digital education, digital health, and digital agriculture. Additionally, cross-cutting themes such as digital content & applications, digital ID, emerging technologies, cybersecurity, privacy and personal data protection, and research and development are integral to supporting the digital ecosystem illustrated by the conceptual framework in Figure 1.8.

The strategy also highlights that Africa faces challenges regarding dependable, sustainable, and resilient infrastructure. Moreover, Africa's youth will need advanced digital and life skills, encompassing scientific, digital, financial, and cultural fluency, along with critical thinking, problem-solving abilities, and leadership qualities. Additionally, the strategy stresses the importance of nurturing highly skilled individuals who can drive digital innovation and competitiveness in Africa, highlighting the essential requirement for collective digital capacity (African Union, 2020).

Figure 1-8: AU's DT conceptual framework



Note: The AU's DT conceptual framework illustrates the various components of the African ecosystem, 2020, p. 9.

Despite the AU's holistic approach, one notable gap in the pillars and cross cutting themes is cultural heritage or indigenous knowledge.

The background review reveals that while South Africa's aspirations for DT align with global and continental frameworks, with a policy and regulatory environment that embodies aspirations for people-centred DT, the absence of a unified national DT framework has resulted in fragmentation. Various government departments and entities are responsible for implementing different components of the DT vision, leading to siloed approaches. As observed by the South African Department of Planning, Monitoring, and Evaluation (DPME), this fragmentation hampers the effective and cohesive implementation of a comprehensive digital transformation strategy. Similarly, Shibambu and Ngoepe (2023) posit that the South African government lacks legislation and strategy for digital transformation, leading to inconsistent implementation of digital transformation that enhances service delivery in the public sector of South Africa.

Notably, the fragmentation of DT efforts in South Africa is not unique to the country but is part of a broader continental issue. Across Africa, many nations face similar hurdles in developing a conducive environment for the DKE, with fragmented approaches to implementing digital transformation strategies (Marwala, 2022). Moreover, Marwala highlights that while South Africa and the broader African continent have historically been perceived as receivers of innovation rather than producers, the 4IR offers a pivotal opportunity to change this dynamic for Africa to not only participate in global innovation but actively drive it. However, this will require harmonised efforts across various sectors and collaboration at both national and international levels. Similarly, Marivate et al. (2021) argue that South African policymakers should avoid simply adopting strategies from developed countries when attempting to lead in the 4IR. Instead, they suggest that South Africa must focus on identifying and applying innovations suited to its unique context, allowing the country to carve out its own place in the global community and create opportunities for its people.

In conclusion, the background discussion reveals critical gaps, including the inadequate integration of IKS in existing frameworks. This omission reinforces power dynamics, marginalises context-specific ontologies and epistemologies, and limits the potential for facilitating inclusive DT. Addressing these gaps requires the adoption of holistic and culturally embedded frameworks and approaches that unlock collective human capabilities, empowering communities to actively shape their digital futures.

1.7 Thesis roadmap

In the previous sections, I discussed the research problem and the significance of the study, as well as the evolution of DT in South Africa and its intersection with the continental and global ecosystems. To address these gaps, this study employs several key concepts discussed below to explore the research questions.

Culturally embedded frameworks and collective human capabilities: In this study, these terms refer to communal ways of being, knowing and doing, and community agency. Cultural frameworks encompass the range of cultural elements practised within a group in a specific context, including values, attitudes, beliefs, norms, traditions, and institutionalised social practices, as elaborated by Pahl-Wostl et al. (2008). Community agency, as defined by Matarrita-Cascante et al. (2010), denotes the capacity of communities to self-organise, manage resources (both digital and non-digital), and drive their day-to-day processes to achieve socio-economic goals.

DT: Entails the progressive and non-prescribed utilisation of ICTs and digital technologies to empower individuals to pursue their aspirations within the DKE (Avgerou, 2010; Ndemo & Weiss, 2017).

Active and inclusive participation: In this study, active and inclusive participation refers to intentional engagements with African cultural knowledge systems (ontology and epistemology) as the foundation for contextual DT and innovation. Participation, as explained by Quick & Feldman (2011), involves soliciting public input for specific programs or policies, while inclusiveness represents a more comprehensive and ongoing process that continuously engages the community in defining and addressing public issues. Inclusivity is a process involving the co-production of processes and content, embracing diverse perspectives, and fostering sustained engagement and ownership within

the community. This study adopts Quick and Feldman's (2011) perspective on inclusion and adds the concept "active" to emphasise that participation and inclusiveness require proactive and intentional efforts to ensure that individuals engage in the DT.

Context: The context for this study is resource-constrained environments, which are rural or remote areas with limited digital infrastructure, such as limited connectivity, availability, and accessibility of technological resources, such as computers, and a lack of advanced digital skills (Anderson et al., 2012). In this study, context refers to the broader environmental factors, conditions and processes in the DT ecosystem that enable or constrain active and inclusive participation of communities in a resource-constrained environments. (Takavarasha et al., 2017), posit that contextualism not only considers the historical factors that have shaped the current situation but also takes into account the ongoing social dynamics that are influencing future developments. Therefore, context is not static but rather something that is continually shaped and influenced by interactions, relationships, and changes over time (Hayes & Westrup, 2012).

Digital transformation leadership: In the context of this study, digital leadership is conceptualised as a multifaceted concept that encompasses a broad range of elements, extending beyond policy and regulations and technical expertise to include areas such as strategy, culture, vision, competencies, mindset, and talent management (Jameson et al., 2022).

Figure 1.9 provides a roadmap for the thesis. In the next chapter, I discuss the literature review to contextualise the research problem and the significance of the study.

Figure 1-9: Thesis roadmap

CHAPTER TWO:LITERATURE REVIEW AND RESEARCH THEORETICAL FRAMEWORK: EVOLVING ICT4D DISCOURSES

2.1 Introduction to Systematic Literature Review (SLR) Technique
2.2 Analytical and theoretical framework: Hanna's integrated and holistic DT
2.3 A critical examination of ICT4D concerning the dimensions of the research analytical framework for this study
2.4 Reframing ICT4D narratives and embracing the "other"
2.5 In pursuit of epistemic freedom: Exploring Mandhwane, a culturally embedded approach to DT
2.6 Botho, Mandhwane and mind mobilisation: Lessons from Tshepo Khumbane
2.7 Chapter summary

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY: SOCIAL CONSTRUCTIVIST CASE STUDY

3.1 Introduction
3.2 Research methodology
3.3 Research design: Mixed-methods case study
3.4 Data analysis
3.5 Limitations of the study
3.6 Chapter summary

CHAPTER FOUR TO SEVEN: DATA PRESENTATION ACCORDING THE COLOR CODED DIMESIONS OF THE ANALYTICAL THEORETICAL FRAMEWORK

Chapter 4: Micro-level perspectives: Case study of cultural preservation (E-heritage prototype)
Chapter 5: Micro-level perspectives: Case study of financial management (Fintech prototype)
Chapter 6: Micro-level perspectives: Case study of early Agri-tech conceptualisation
Chapter 7: Macro and meso-level perspectives on culturally embedded DT

CHAPTER EIGHT: DATA ANALYSIS AND DISCUSSION

Digital transformation in the Mamaila Tribal Authority: toward an African-inspired, contextual, non-prescriptive and non-descriptive approach for inclusive participation in the digital knowledge economy

CHAPTER NINE: THESIS STATEMENT, CONTRIBUTION TO KNOWLEDGE, ORIGINALITY AND RECOMMENDATIONS

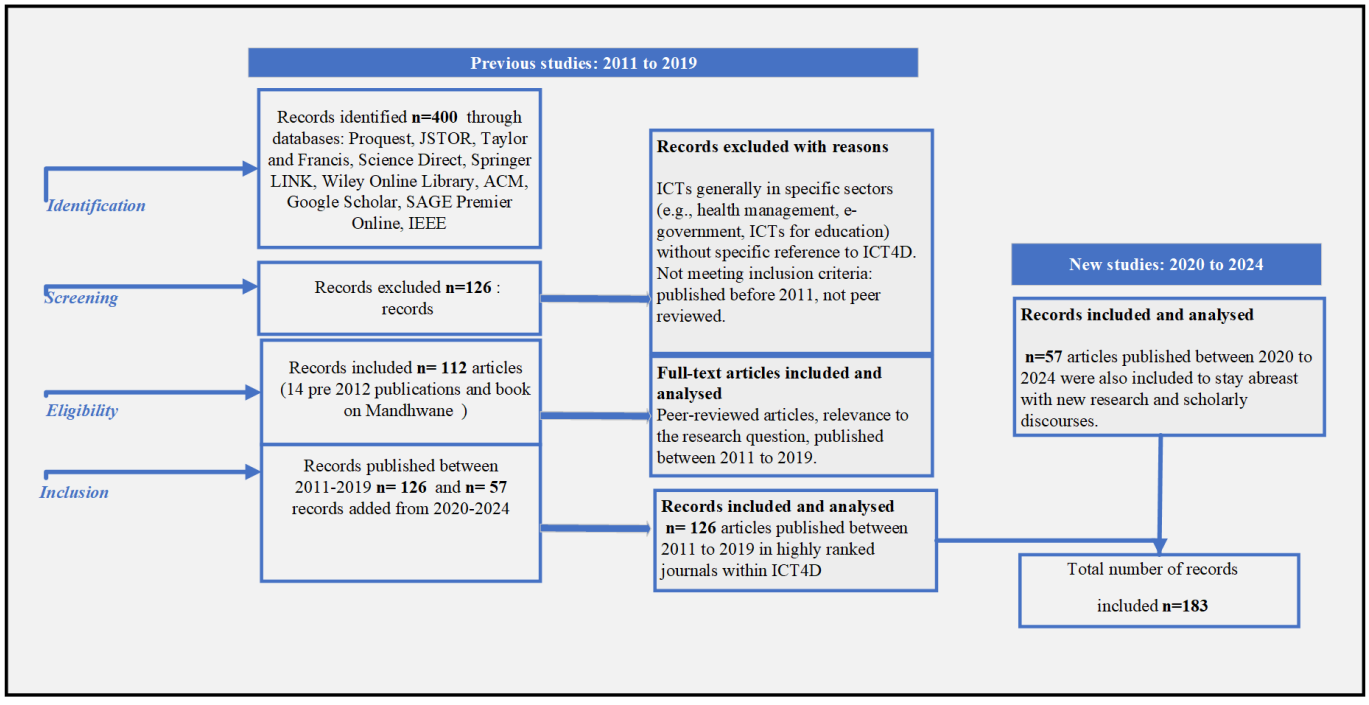
Introducing the Digital Mandhwane Theory (DM-T): an emic contribution to scholarly discourses in contextual digital transformation

CHAPTER 2 ：LITERATURE REVIEW AND RESEARCH THEORETICAL FRAMEWORK: EVOLVING ICT4D DISCOURSES

2.1 Introduction to Systematic Literature Review (SLR) Technique

The background discussion highlights that globally, stakeholders in development settings and governments agree on the transformative potential of ICTs in enabling development goals. However, in Africa, specifically South Africa, there are challenges such as an inadequate, lack of digital skills needed to advance homegrown solutions, inadequate uptake and usage of digital services and products, and a focus on supply-driven metrics and meeting/responding to global benchmarks. In this chapter, I provide a comprehensive SLR of the evolving scholarly ICT4D discourses and paradigm shifts, which is crucial for understanding the research problem. SLR serves as the foundation for making research decisions by employing a well-defined methodology to identify research gaps, summarise empirical evidence, and provide a framework for positioning new research activities in an unbiased manner, as well as demonstrating how proposed research contributes to advancing knowledge (Bai et al., 2019; Kitchenham & Charters, 2007; Xiao & Watson, 2017). I used the steps outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) illustrated in Figure 2.1 to systematically review the existing literature, laying the foundation and contextualising the research problem. Haddaway et al. (2021) posit that PRISMA methodology promotes transparency through the use of flow diagrams to illustrate review procedures and track the exclusion of irrelevant records.

Figure 2-1: An adapted PRISMA flow diagram capturing the SLR employed in this study



Note: This figure illustrates the PRISMA methodology employed in this study. Source: Author, 2024

PRISMA flow chart encompasses four categories; identification, screening, eligibility, and inclusion (López-Sánchez et al., 2023).

While I followed the PRISMA steps to conduct the SLR, I did not rely solely on PRISMA as the methodology for exploring the research problem; instead, I collected additional data to deepen my understanding. In the section below, I discuss the steps that I followed to systematically review the literature to gain insights into scholarly discussions in ICT4D, including identifying scholarly recommendations aimed at addressing deficiencies in ICT4D including the presentation of the PRISMA diagram.

2.1.2 PRISMA SLR methodology and ICT4D discourses

When conducting SLR, researchers should describe all elements of the review including their inclusion criteria, search strategies, quality assessment criteria, screening procedures, and strategies for data extraction, synthesis, and reporting Xiao and Watson (2017). My review focused on exploring:

- How *cultural knowledge systems* are integrated within the planning and implementation of ICT4D intervention, including the transfer of *digital skills*?
- What is the appropriate *infrastructure* required to enable socio-economic aspirations and *promote adoption and usage* in targeted communities?
- What constitutes participation in the DKE, and the key stakeholders (***leadership***) responsible for driving rural DT.

Identification: Figure 2.2 provides insight into the database search strategy. I identified 400 peer-reviewed articles using Boolean logic along with field-specific limitations, using AND/OR to search across various databases including ProQuest, JSTOR, Taylor & Francis, ScienceDirect, SpringerLink, Wiley Online Library, ACM, Google Scholar, SAGE Premier Online, IEEE, and ACM. The selected keywords enabled me to conduct an interdisciplinary and critical analysis of peer-reviewed articles.

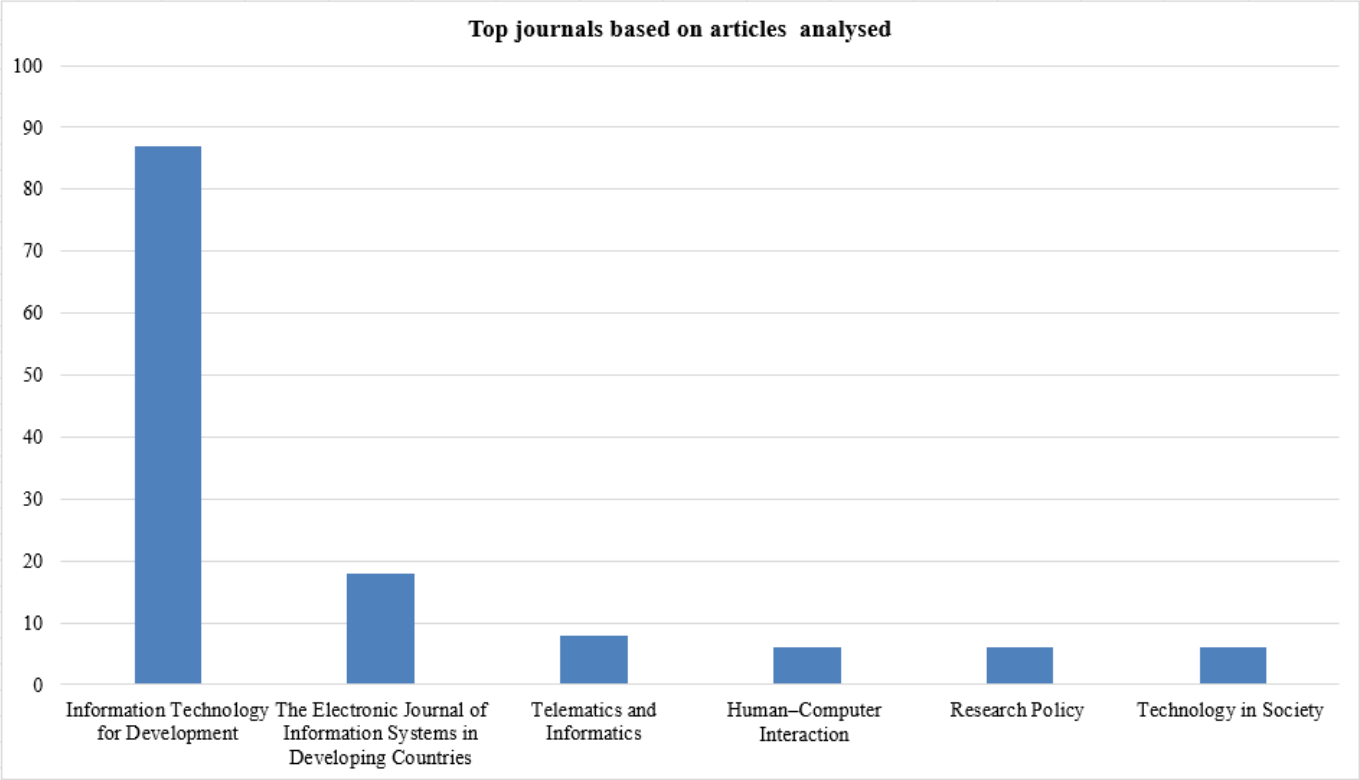
Figure 2-2: Example of a database, keywords employed, search strategy, and the results

Search results: 147 results found for (**ICT**) and culture AND LIMIT-TO(**topics, "internet"**) AND LIMIT-TO(**contenttype, "JL,BS","Journal"**) AND LIMIT-TO(**cids, "271579,271802,271735,272070,271744,271785,271666","Telematics and Informatics,Computers in Human Behavior,Telecommunications Policy,Government Information Quarterly,Technology in Society,Journal of Rural Studies,Research Policy"**) AND LIMIT-TO(**topics, "internet,internet access,rural"**).		
database	**keywords**	**research results**
ScienceDirect	digital transformation and rural afica	31
	complexity theories and management	71
	Rural connectivity and Africa	42
	culture, ICT and Africa	118
	ICT4d theory	31
	Afrocentric research and Information Tech	1
	culture and internet	147
Search results: 52 results found for (**ICT**) and hofstede AND LIMIT-TO(**topics, "internet,technology,culture,cultural,innovation"**).		

Note: This Figure illustrates the search strategy employed in this study. Source: Author, 2024

I used the following keywords to search: CT and culture, ICT for development, Afrocentricity, ICT4D and capability, ICT, and postcolonialism, ICT and economy, national culture, adoption of technology, DT and rural Africa, complexity theories and management, rural connectivity and Africa, culture, ICT and Africa ICT4D theory, Afrocentric research and information, culture and internet ICT4D infrastructure, community networks, community participation, KE, social learning, observational learning, ICT and Ubuntu, ICT4D and Ubuntu, Ubuntu, world philosophies, coloniality, development, community informatics, digital technologies, globalisation, ICT4D research, and Mantlwane. Figure 2.3 illustrates that the majority of the articles reviewed and analysed were retrieved from Information Technology for Development and the Electronic Journal of Information Systems in Developing Countries, and Telematics and Informatics downloaded from the Taylor & Francis, Wiley Online Library, and ScienceDirect databases.

Figure 2-3: Top 3 journals based on articles downloaded, read, and analysed



Note: This Figure illustrates the top journals included in the SLR. Source: Author, 2024

Screening: During the screening, I excluded 126 records because they focused on specific sectors such as health management, e-government, or ICTs for education without mentioning ICT4D.

Eligibility: After the screening, I deemed 112 articles eligible for full review. This included 14 records published before 2011, including a book specifically related to Mantlwane. I included these 14 records because they provided supporting arguments on concepts such as participatory rural approaches, community networks, and community

informatics. Research topics often gain popularity during specific eras based on current discourses in particular fields of study. For example, between 2017 and 2019, there was limited research on DT compared to the period from 2020 to date.

Inclusion: In total, I included 126 articles published between 2011 to 2019. This timeframe was chosen based on previous SLRs by scholars like Gomez (2013), Ramadani (2017), and Chipedza and Liedner (2019), which collectively covered the period from 1982 to 2016 in the field of ICT4D. Additionally, I included 57 articles published between 2020 and 2024 to incorporate recent research and scholarly discussions. In total, I reviewed and analysed 183 articles.

2.1.3 SLR analysis and findings: Foundational understanding of the research dimensions

I conducted the SLR to establish a foundational understanding of the dimensions of the research analytical framework discussed in detail in *Section 2.2*. The review indicates that the use of technology for societal change is part of IS, which is a specialised branch of the computing field that focuses on the design, creation, implementation, and management of software applications, as well as their impact on businesses, organisations, and communities (Kroeze, 2022). Thus, ICT4D is a sub-discipline of IS and an interdisciplinary field that draws upon fields such as development studies, information systems, computer science, geography, management studies, media and communication studies, design science, gender/feminist studies, and a large number of disciplines (Zheng, 2015). The field incorporates various theories including the capability approach (CA), actor-network theory, diffusion of innovation theory, and the technology acceptance model (Sein et al., 2019). Within the broader IS discipline, intersecting sub-disciplines include human-computer interaction (HCI), human-computer interaction for development (HCI4D), and CI. HCI4D originated at the convergence of ICT4D and human-computer interaction (van Biljon & Karen, 2021). According to the authors, while there is a notable emerging maturity, some of the challenges in HCI4D include the prioritisation in designing new interventions, the limited integration of existing literature, practical obstacles in sustaining multi-year initiatives, and potential gaps in recognising diverse research areas. On the other hand, HCI primarily focuses on techniques and resources for creating interfaces between humans and computers, evaluating the user-friendliness of computer systems, and addressing broader human-centred matters, such as the dynamics of HCI (Park & McKilligan, 2018).

In contrast, CI focuses on enabling community processes and improving the well-being of people and their communities through effective technology use (Mixson, Kahai, Sankar & Song, 2016; Stillman & Denison, 2014). CI mainly emphasises the essential factors that influence system design, which revolve around the social and communal aspects, including users, their specific requirements, and the abilities and strengths of the community members. However, just like ICT4D, CI is criticised for its ideological stances of positivism and determinism (Pitkin, 2001). Some scholars propose the integration of the CA to address theoretical, practical, and research gaps in CI (Stillman & Denison, 2014). Given the limitations of HCI4D, CI, and HCI, the literature review for this study focuses

on ICT4D as the primary sub-discipline within IS.

The review reveals that ICT4D initiatives often reflect Western epistemology, which may not align with local contexts in developing countries, potentially leading to project failures (van Stam, 2012). Despite attempts to consider indigenous theories by incorporating Ubuntu attributes such as kinship into projects as reported by Abubakre and Mkansi (2022), the review highlights limited evidence on the holistic embeddedness of context-specific cultural knowledge systems, practices, and processes into ICT4D. Moreover, while there is evidence of implementing projects that aim to preserve indigenous knowledge systems using digital technologies and applications, the attempts to integrate cultural knowledge systems are often handled at a simplistic level (Mkabela, 2005; Reitsma, Smith, & van den Hoven, 2013; Winschiers-Theophilus & Bidwell, 2013).

Furthermore, the review highlights that SLRs conducted by scholars between 2013 and 2023 collectively critique ICT4D initiatives for their Eurocentric bias, the predominant focus on technology adoption, and economic metrics such as GDP (Chipidza & Leidner, 2019; Devinder & Øystein, 2014; Gomez, 2013; Ramadani, 2017; Schelenz & Pawelec, 2021). While some scholars have previously advocated for decolonisation (Krauss, 2018; van Stam, 2012), recent literature shows a growing call for paradigm shifts toward this goal, indicating the reflective capabilities of ICT4D scholars. Moreover, researchers argue that Global South scholars must play a significant role in conceptualising the governance of digital technologies and critically examining and problematising the original views of ICT4D (Davison, 2021; Masiero, 2022; van Stam, 2021).

The review further illustrates evolving discourses in ICT4D suggesting that, despite the positive contributions of ICT4D in facilitating financial inclusion, access to health, government e-services, education, and enabling agricultural services amongst others, various scholars critique its shortcomings relating to technological determinism, the collision of worldviews, the Eurocentric bias associated with the colonial roots of the term “development” its historical connotations and implications, such as the imposition of Western ideologies, reinforcement of power dynamics, and marginalisation of indigenous knowledge and perspectives (Masiero, 2022; Jimenez et al., 2022; Schelenz & Pawelec, 2021; van Stam 2012). On the other hand, while there is evidence of ICT4D's success, scholars continue to critique its theoretical framing, specifically the “development” and the prescriptive connotation of “for development”. The failure to produce the desired development impact is well-documented, prompting various scholars to suggest the necessity of focusing on theories that establish a visible link between technology and development outcomes (Coelho et al., 2015; Jurado-Gonzalez & Gomez-Barroso, 2016). Masiero (2022) posits that in a world where the term “development” is increasingly colonial, ICTs can be harmful and exploitative, calling for a critical examination and problematisation of the original views of ICT4D. These critiques of ICT4D’s Eurocentric foundations are part of a larger concern with how development itself is framed and theorised, especially within the context of modernisation and neoliberal paradigms.

In the context of the modernisation paradigm and neoliberalism, development is associated more with providing material capacities than with providing immaterial capabilities (Kim & Lee, 2023). Kunst (2015) notes that not only is it problematic to define development, but finding empirical evidence for the impact of ICT4D is complicated due

to the environment in which ICT4D occurs, making it challenging to assign changes in human behaviour to the use of ICTs. Chipidza and Leidner (2019) highlight four aspects of development in the context of ICT4D, namely development as increased freedom, as expanded inclusion, as increased economic productivity, and as improved well-being. Development as well-being focuses on ICT4D interventions that aim to reduce poverty by increasing people's ability to earn or generate income and profit and to enhance individuals' quality of life and livelihoods through ICT-enabled opportunities (Chipidza & Leidner, 2019).

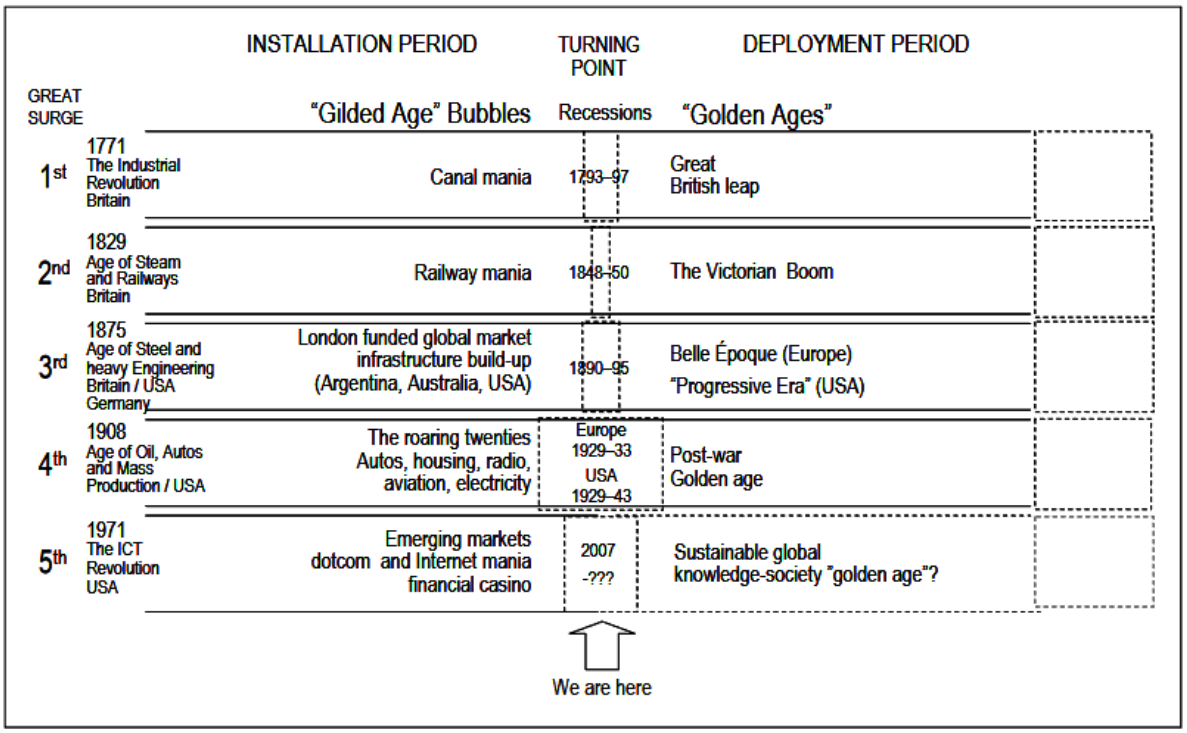
While ICT4D focuses on specific developmental outcomes, Tandon (2015) describes development as a self-defined process that leads to self-empowerment instead of the mechanistic process that outsiders drive. Similarly, the self-defined perspective requires a shift from an ICT-enabled development conceptualised as meeting people's needs to an aspiration-driven ICT4D strategy to avoid myopic technological interventions (Toyama, 2018). Furthermore, this shift in perspective aligns with Roberts and Poveda's (2018) assertion that ICT4D must go beyond addressing immediate practical needs and focus on fulfilling people's strategic interests. Therefore, scholars might gain insight into the crucial role of ICT4D as part of the innovation system in a globalised environment by understanding what development means in an African context (Andrade & Urquhart, 2012; Walsham, 2017). Thus, a context-sensitive, aspiration-driven approach to ICT4D, recognises the potential for ICTs to inadvertently exert epistemic violence against local knowledge systems, as they are not neutral tools and can disrupt or marginalise indigenous ways of knowing, thereby imposing externally driven "development" (Rau et al., 2008).

In response to the critiques and limitations of traditional ICT4D, the concept of digital transformation for development (DX4D) has emerged as a more radical and inclusive approach, aiming to reshape development processes through digital systems (Heeks et al., 2022). This shift towards DT is supported by a common thread in the literature, which suggests that, despite its multidimensional nature, DT is an inevitable change driven by digital technologies that influence all human activities. DT alters the people, processes, technology, and data components of an organisation to change business models, serving existing customers more efficiently and reaching new customers more effectively by leveraging current and emerging digital technologies (McCarthy et al., 2021; Vial, 2019). The DT discourse, although often framed as a recent phenomenon, finds its roots in historical technological revolutions that have profoundly shaped economic and societal structures over the past 200 years. In this regard, Perez's (2010) historical framework provides valuable context for today's digital transformation. Perez identifies five technological revolutions that have reshaped global economies and societies: the Industrial Revolution; the Age of Steam and Railways; the Age of Steel, Electricity, and Heavy Engineering; the Age of Oil, the Automobile, and Mass Production; and the Age of Information and Telecommunications. Each of these revolutions not only brought about significant shifts in productivity, societal norms, and economic growth but also involved a tumultuous process of integrating new technologies across diverse sectors.

The Age of Information and Telecommunications is characterised by information intensity, decentralised integration, and global interconnectedness. However, as Perez (2012) notes, the distribution of these innovations is far from

uniform. Sectors and regions that are better equipped to harness new technologies tend to progress more swiftly, while others, particularly those in resource-constrained environments, face challenges in integrating and benefiting from these advancements. In South Africa's case, this reflects the country's struggle with closing the digital divide between urban and rural areas, wealthy and poor communities. While some sectors, like finance and certain urban areas, thrive from technological advancements, others, particularly in resource-constrained environments, remain underserved. Marwala (2022) highlights the importance of innovation within the 4IR, emphasising its potential to disrupt and reshape industries. Furthermore, Marwala argues that the 4IR should prioritise inclusive growth, addressing socio-economic challenges such as poverty, inequality, and unemployment, especially in South Africa. This perspective on innovation underscores the need for ICT4D strategies that are not solely focused on technological deployment but are also mindful of the broader socio-economic context. Therefore, understanding the historical evolution of digital technologies, along with their transformative yet uneven impact, is crucial for developing ICT4D strategies and interventions in resource-constrained environments.

Figure 2-4: Five technological revolutions observed by Perez



Note: This figure illustrates various technological evolution (Perez , 2012, p. 211).

Moreover, scholars agree that DT is a process that depends on digitisation and digitalisation. Digitisation involves converting analogue data into a digital form, enabling computers to store, manipulate, and transfer it. Digitalisation, on the other hand, applies information technology or digital tools to modify and improve current business procedures (Verhoef et al., 2021). This shift towards digital transformation is central to the broader concept of the digital economy (DKE), where digital technologies become the foundation for all aspects of business operations, customer interactions, and product delivery. The literature review also indicates that DT, whether in the context of business or societal transformation, is interconnected with the DKE. The digital economy is an economy that utilises digital

technologies as the foundation of its products and services, operations, customer interaction, and overall business model (Davidovski, 2018). Davidovski argues that digitalisation is about the journey of getting to the KE, while DT represents an overarching approach for applying digitalisation and encompasses all the aspects of changes required to realise it.

Thus, DT plays a crucial role in sustainable development by catalysing positive change, provided there are investments in human capital, where individuals acquire health, knowledge, skills, and abilities. In addition, technological growth supports economic development and creates physical capital in the form of goods and services (Qureshi, 2023). However, despite the positive contributions to the SDGs, Heeks et al. (2023) caution against the potential disruptions caused by DT. To mitigate these disruptions and adversities, the principles of DX4D offer a holistic framework for addressing interconnected dynamics at both the micro- and macro-levels, emphasising the importance of clear developmental goals, promoting technology neutrality, and recognising both positive and negative impacts (Heeks et al., 2023). In this context, DX4D goes beyond the limitations of earlier ICT4D paradigms, acknowledging that digital systems must address not only immediate needs but also deeper structural and epistemic issues in development. This approach emphasises the interaction between macro, meso, and micro-level actors to foster more inclusive and sustainable transformation.

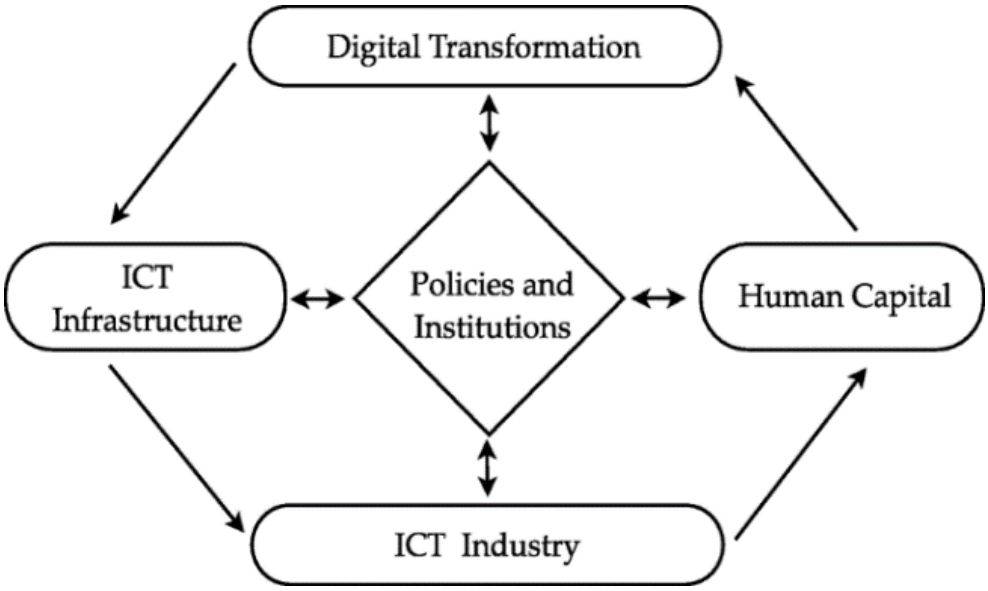
Consequently, the challenges and gaps identified in the scholarly discourses on ICT4D are reflected in the emerging discourses on DX4D, indicating that both fields face similar obstacles. Despite the shortcomings, the SLR indicates reflexivity, growth and maturity in theory and practice, alongside paradigm shifts towards contextual DT. However, there remains a challenge in translating scholarly recommendations into tangible practices. Therefore, to contribute to the scholarly discourses, this study adopts the holistic and integrated digital framework adapted from Hanna (2018) to analyse the dynamic nature within which ICT4D is implemented and its intersection with socio-economic, cultural, and technological factors to shape the desired outcomes.

2.2 Analytical and theoretical framework: Hanna's integrated and holistic DT

ICT4D occurs in a dynamic, complex, multifaceted, and ever-evolving DT ecosystem (Appio et al., 2021). In this context, DT frameworks, which encompass a broad range of components such as people, processes, technology, and policy, provide a comprehensive structure for understanding and navigating these complexities. The literature analysis highlights that researchers tend to focus on individual components of the DT ecosystem, frequently neglecting the interrelations among these components and the system as a whole. Therefore, adopting a holistic and systems-thinking approach is crucial to fully address the complexities of DT. This requires considering not only technological factors but also human and cultural dynamics that influence the success of digital initiatives. To better understand these dimensions, scholars have examined DT from various perspectives. Nadkarni and Prügl (2021), for instance, dissect DT into two distinct but complementary approaches: the technology-centric and the actor-centric. The technology-centric approach focuses on aspects like technology capability, integration, value creation, competitiveness, consumers, and stakeholders. Conversely, the actor-centric approach emphasises transformative leadership, organisational culture, work environment, and managerial and organisational capabilities. This study

adopts Hanna's framework, illustrated in Figure 2.5, which offers a holistic and integrated perspective on the DT ecosystem (Hanna, 2018). Hanna's framework considers all system components, examining the interplay of technology, policy, and social change dimensions, and includes human capital, digital infrastructure, and DT applications. Furthermore, the framework distinguishes itself by focusing on the economy and society as central to DT, in contrast to other frameworks that mostly view people merely as labour inputs and consumers of digital products.

Figure 2-5: Hanna's DT ecosystem



Note: Hanna produced this framework to illustrate the interplay and interrelation of the components of the DT ecosystem (Hanna, 2018, p. 1–16).

The key components of the Hanna framework are the following:

- **Enabling policies and institutions:** These encompass the necessary tools of the state to coordinate and synergise the entire DT ecosystem. They create an environment that enhances interaction among all elements of the transformation process and promotes the effective supply and use of ICTs in all sectors of the economy and society, fostering trust in the digital economy.

- **Human capital:** Skilled human resources lie at the heart of the digital revolution, serving as both users and producers. The resources include policy, technical, and change management skills, as well as broad information and digital literacy, and techno and data entrepreneurship.

- **ICTs and the data industry:** A dynamic digital industry ecosystem is necessary to adapt globally available technology solutions to local needs, to manage and maintain technological infrastructure, to develop local digital content and solutions, and to effectively partner with global suppliers of ICTs. Local software development and data analytics capabilities represent a core competency that enables various and effective domestic uses of digital technologies.

- **Digital infrastructure:** This encompasses affordable and competitive communication infrastructure, including affordable access to the Internet and ICT tools, broadband, and platforms such as cloud computing and digital payment systems.

- **DT applications:** This component includes digital technology applications and complementary investments in institutional capabilities to transform key ICT-user sectors of the economy, including digital government, digital commerce and finance, and DT of other priority economic sectors.

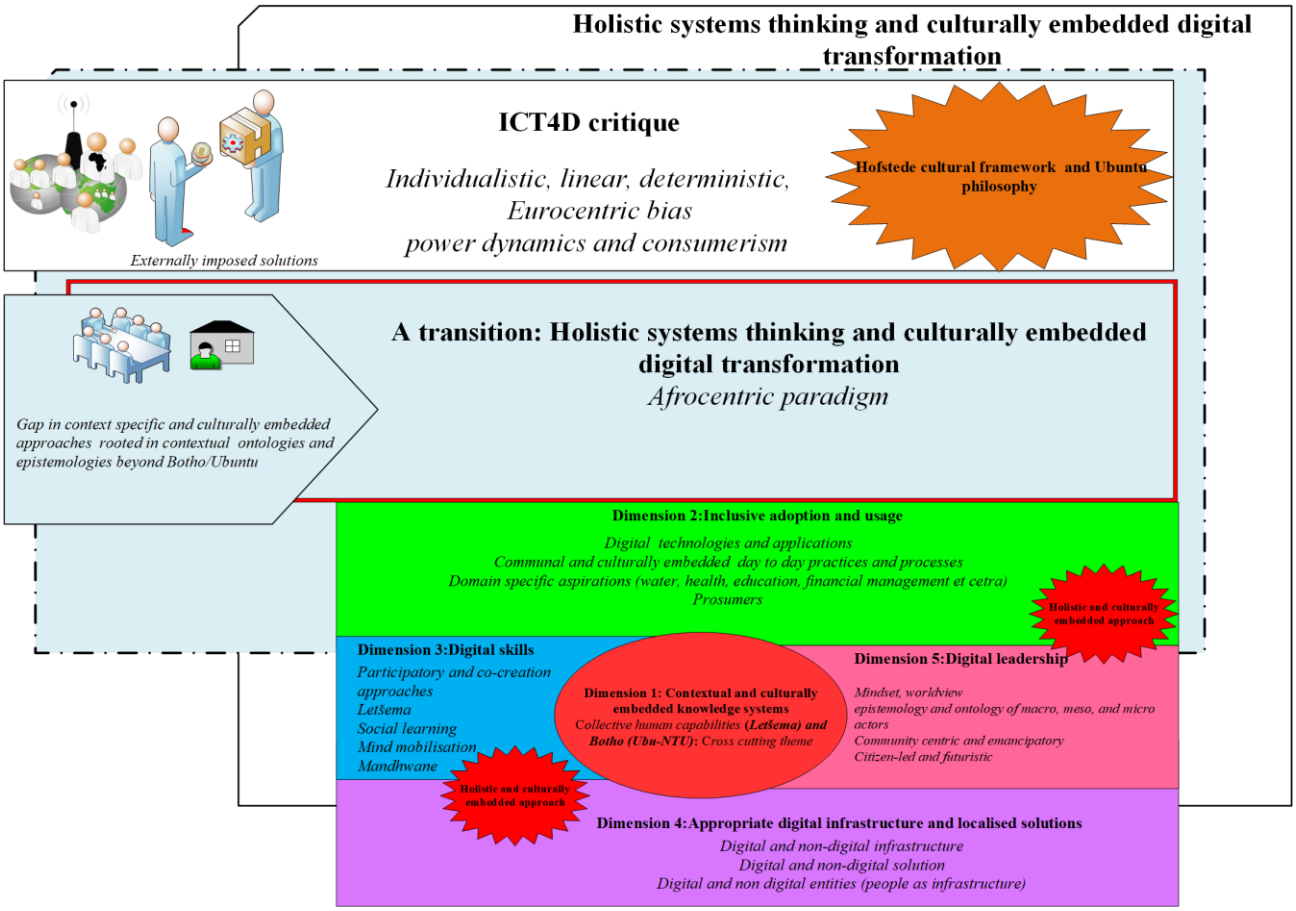
Policies and institutions are the focal point of the framework because the lack of leadership and clear policies and regulations to stimulate innovation and create an enabling environment for holistic DT could constrain all the other components of the framework (Hanna, 2018). Furthermore, providing infrastructure without addressing digital skills (human capital), lacking industries to supply the necessary services and products, missing digital applications, neglecting customer-centric strategies, and failing to understand the socio-cultural context might not produce the desired impact According to Qureshi (2023), "unless there is a transformation in capabilities, access to ICTs, requisite skills and knowledge, then digital transformation will merely exacerbate existing inequalities" p. 432. In contrast to the business focus on DT, in sustainable development narratives, human capital is key to effective DT as it can fuel sustainable development when people use ICTs to lead the lives they choose to live. Thus, the components of the ecosystem affect each other. In light of this interconnectedness, while the components of the digital ecosystem are critical for creating an enabling and sustainable environment for DT, many features of digital ecosystems can be considered complex and multifaceted adaptive systems (Abrahams, 2017). According to the author, the various features of the digital ecosystem constantly shift, providing new competitive advantages or threats, new opportunities, and unexpected outcomes. This shifting dynamic underscores the importance of leadership's capacity to adapt and respond effectively. Therefore, leadership or actors in the ecosystem should apply systems thinking and complexity science to manage and respond to the digital complexity ecosystem, specifically in the Southern Africa region.

As such, Turner and Baker (2019) posit that complexity theory can assist present and future leaders with comprehending sophisticated technology, globalisation, complex markets, cultural shifts, and other phenomena. Addressing the challenges observed by scholars through traditional linear methods risks partial analysis and the illusion of resolution. A holistic systems-thinking approach is therefore crucial (Turner & Baker, 2019; Turpin & Alexander, 2014). To further enhance the framework's applicability and relevance, while Hanna's framework provides a holistic and systemic understanding of DT, it benefits from the inclusion of sociological traditions, which bring a critical lens to understanding individual and collective agency, as well as power dynamics. The adapted framework for this study, illustrated in Figure 2.6, incorporates African cultural knowledge systems as a cross-cutting dimension, emphasising the importance of grounding DT in local contexts and practices. The components of the dimensions within the adapted framework for this study are as follows: contextual and culturally embedded knowledge systems; inclusive adoption and usage; digital skills; appropriate digital infrastructure; and digital leadership. Contextual and culturally embedded knowledge systems serve as a cross-cutting dimension.

- **Contextual and culturally embedded knowledge systems:** Emphasise intentional engagements with African cultural knowledge systems, as the catalysts to unlock collective human capabilities.

- **Inclusive adoption and usage:** Emphasises the integration of technology into existing communal practices and processes.
- **Digital skills:** Underscores the importance of building digital skills within communities through participatory and co-creation approaches.
- **Appropriate digital infrastructure:** Considers local contexts and preferences, including both digital and non-digital solutions and entities, including people as infrastructure.
- **Digital leadership:** Explores the role of leadership in facilitating a people-centred and transformative digitally connected-development

Figure 2-6: Research analytical framework (adapted from Hanna, 2018): The naïve picture of a holistic system thinking and culturally embedded DT



Note: This figure illustrates the author's adaptation of Hanna's framework, depicting the naïve picture of holistic system thinking and culturally embedded DT. The adapted framework introduces cultural knowledge systems, practices, and processes as a cross-cutting dimension within the analytical framework.

In the context of this study, digital leadership is conceptualised as a multifaceted concept that encompasses a broad range of elements, extending beyond policy and regulations and technical expertise to include areas such as strategy, culture, vision, competencies, mindset, and talent management (Jameson et al., 2022). Building on this understanding, the analysis of digital leadership competencies encompasses the examination of leadership traits, vision, knowledge, a willingness to fail and learn, the empowerment of others, and the management of diverse teams (Magesa & Jonatan, 2022; Schiuma et al., 2021). Therefore, it is critical to analyse digital leadership beyond technology-centric and actor-centric perspectives by incorporating the sociological traditions lens proposed by Jackson et al. (2021), which provides a valuable perspective that complements the policies and institutions component in the Hanna's framework. The sociological lens encompasses four approaches:

- **The Marxist :** Examines power relations and economic structures to address inequality.
- **The functional-utilitarian:** Uses digital technologies to improve social well-being.
- **The Durkheimian:** Explores the influence of social bonds and norms.
- **The micro-interactionist:** Focuses on individual actions in shaping DT.

Moreover, using a sociological tradition perspective as a complementary conceptual framework to Hanna's framework is crucial for better understanding how a specific sociological standpoint impacts a country's DT (Jackson et al., 2021). A country's DT is influenced, in part, by the cultural aspects deeply ingrained in its institutions, which can often be resistant to change(Jackson et al., 2021). It is vital to critically examine the external pressures that shape the African development agenda and how the continent responds to the agendas of external stakeholders, to ensure that institutional frameworks align with the needs and priorities of African communities (Ayodele, 2021).

Building on the sociological perspective, another critical factor influencing DT is the mindset of the individuals involved in the process. Digital mindset encompasses individually held beliefs regarding personal and situational resources in the context of technological change (Solberg et al., 2020). For example, digital leaders must possess a digital mindset, encompassing a positive attitude toward digital technologies and their applications, along with a digital skill set involving an understanding of technology, and the ability to discern the opportunities and risks associated with DT (Magesa & Jonatan, 2022). According to Hildebrandt et al. (2022), mindset, when explored through various lenses, offers a multifaceted understanding of how individuals approach and engage with DT. Firstly, the method lens perceives mindset as a set of cognitive processes that individuals use to tackle problems. Secondly, the filter lens emphasises how knowledge and experiences shape the mindset, ultimately influencing perception. Lastly, the belief lens highlights mindset as comprising fundamental identity beliefs, which play a crucial role in shaping individual thought processes. Together, these perspectives provide a comprehensive framework for understanding mindset, encompassing a range of cognitive processes and influences. Hildebrandt et al.'s (2022) conceptualisation of the digital mindset provides a holistic perspective beyond the conventional approaches that often reduce mindset to a set of attributes and the separation of mindset from people's identities, positionalities, and self-concepts shaped by historical legacies.

The theoretical framework developed for this study integrates key aspects of Hanna's framework, sociological traditions, and culturally embedded perspectives. This integrated approach enables a comprehensive understanding of DT in African contexts by addressing technical, infrastructure, social, cultural, and leadership dimensions simultaneously. This unified framework provides the theoretical foundation for analysing the interplay of macro, meso and micro levels and how they shape DT in African rural communities.

In the sections that follow, I provide a critical analysis of the literature relevant to the dimensions of this study. Collectively, the sections contextualise the problem statement and provide a comprehensive roadmap for exploring the research problem.

2.3 A critical examination of ICT4D concerning the dimensions of the research analytical framework for this study

Schelenz and Powalec (2021) assert that critical examination not only enhances societal understanding and refines social theories but also promotes emancipation. Moreover, the authors argue that critical examination work is inherently political, as it provides opposition to dominant positions and aims to reform or transform the subject at hand, both in research and practice. Building on this perspective, in this section, I provide a critical examination of ICT4D dimensions relevant to this study. This critical analysis is crucial for exploring the research problem and understanding the evolving discourses and paradigm shifts.

In line with this critical examination, the prevailing deterministic approach identified in the literature suggests that scholars often overlook the holistic nature of ICT4D. The focus is on analysing ICT4D activities as isolated entities rather than considering their interconnectedness within a broader system. This limited perspective fails to account for the complex interactions and dependencies that shape the success or failure of ICT4D initiatives, thereby hindering a comprehensive understanding of their impact. Despite the identified shortcomings, there is a noticeable shift towards multiple perspectives and tools to adequately engage with its interdisciplinary nature and the complexity of the environment in which projects and research are conducted (Heeks & Renken, 2018; Masiero, 2022).

Similarly, Heeks (2022) posit that a holistic approach to DT is crucial, considering the role of policies, institutions, sociological perspectives, individual mindsets, skills, infrastructure, sectors of the economy, human development, and the transformative power of digital technologies, encompassing both positive and negative aspects of digital incorporation. The holistic approach enables the examination of a variety of actors involved either directly or indirectly in a DT on diverse levels of analysis (i.e., individual, group, collective, organisation, and society) by examining how change occurs through individual or collective (inter) action as well as the change that happens in social units (Ndemo & Weiss, 2017). Therefore, considering how entities in the bigger picture affect each other leads to a richer understanding, emphasising a whole view and the interrelationships between system entities (Turpin & Alexander, 2014).

Moreover, successful innovation in ICT4D should consider the interconnected global context, recognise the roles of both individual and collective capabilities, address issues of empowerment and equality, and consider the interplay of the development context, people, and technologies (Bailey & Osei-Bryson, 2018). In the following section, I provide a detailed discussion focusing on dimensions relevant to this study. These dimensions include cultural

frameworks, digital adoption and usage, digital skills, infrastructure and solutions, leadership, and contextualisation. The discussion lays the foundation for a holistic and interdisciplinary exploration of the research problem.

2.3.1 ICT4D cultural frameworks

Schelenz & Pawelec (2021) highlight key failures in ICT4D practice, including the neglect of local cultural contexts and the dominance of top-down approaches. These failures are exacerbated by power dynamics and an over-reliance on frameworks that do not account for the lived experiences and needs of communities in the Global South. Jimenez et al. (2022) argue that to address the challenges facing ICT4D, it is essential to rethink how knowledge is produced and shared, advocating for more inclusive research practices that consider the epistemologies and experiences of communities in the Global South. To effectively address these challenges, it is crucial to reconsider the dominant frameworks and methodologies that have shaped ICT4D practices. To move forward in addressing these challenges, it is essential to critically examine the frameworks and methodologies that have long shaped ICT4D practices.

Western epistemology inherits a particular partiality and bias through embedded assumptions, values, definitions, techniques, frameworks, and models (Winschiers-Theophilus & Bidwell, 2013). Consequently, ICT4D faces several ethical dilemmas because of its interdisciplinary and multiple stakeholders who hold positionalities characterised by cultural, historical, linguistic, social, and economic differences, with related deep inequalities of resources, influence, and power (Dearden & Kleine, 2021). Similarly, researchers place more emphasis on technology instead of communication and the approach is top-down and one-size-fits-all (Kim & Lee, 2023). Top-down approaches reveal power dynamics that perceive communities merely as a list of issues requiring external assistance (Ye et al., 2021). To address these challenges, it is crucial to move beyond simplistic approaches that overlook the deeper, contextual factors at play in ICT4D initiatives. Therefore, when implementing ICT4D projects or initiatives in developing countries, it is essential to consider and embrace the cultural and social factors of the local context rather than solely focusing on quantifiable metrics like literacy, skills, and language (Takavarasha et al., 2017). Deeply ingrained cultural practices are therefore relevant to ICT4D projects because they can lead to failure (Vaidya & Myers, 2021). In light of this, the high rate of failures in ICT4D initiatives in South Africa has been attributed to the complex socio-cultural dynamics of rural communities. Contextualisation is one of the strategies that actors employ to embrace a bottom-up approach that values the lived experiences, aspirations, and knowledge of communities in ICT4D. Contextualisation links to the human mind, behaviour, and language, shaping how people view and interpret the world (Davison & Díaz Andrade, 2018). Thus, contextualisation is about understanding ontology (nature of reality), epistemology (nature of knowledge and how it is acquired), and axiology (values and beliefs) in a specific context.

This complexity in understanding culture highlights the challenges faced when integrating it into ICT4D initiatives (Leidner & Kayworth, 2006). To navigate this challenge, it is essential to recognise that culture is not a fixed or universal concept, but one that evolves through time and within specific contexts. People pass on culture from generation to generation and acquire it through socialisation (Idang, 2015). Additionally, culture is dynamic and context-specific concerning people's ways of being, doing, and knowing, encompassing belief systems and heritage, among others (Martin & Mirraboopa, 2003; Varghese & Crawford, 2021). A cultural framework comprises ideas and ideals (values, attitudes, beliefs, and norms) and traditions and institutionalised social practices (e.g., behavioural

rituals, language, rules, and legal practices) that codify and objectify these ideas and ideals. Cultural frameworks serve as umbrellas for cultural elements practised and observed by a group in a specific context (Pahl-Wostl et al., 2008). According to Pahl-Wostl et al. (2008, p. 484), the cultural framework contains at least the elements of perceptivity, rationality, morality, and prescriptivity:

- Perceptivity: Cultural frameworks select the elements of reality to which attention should be given. In this way, they emphasise what is outstanding or important to observe, broadened, reduced, remembered, or forgotten by the public or individual conscience.

- Rationality: Cultural frameworks provide a structure to evaluate logic and illogic and simultaneously provide a system of meaning to interpret reality. In this way, a cultural framework makes it possible to rationally explain the causes and consequences of a certain phenomenon or process.

- Morality: Cultural frameworks present value judgments about what is morally right or wrong from that selected part of reality.

- Prescriptivity: Cultural frameworks prescribe, implicitly or explicitly, the desirable and undesirable aspects of courses of action, at the same time proposing and structuring prescriptions about how to handle every situation.

In ICT4D, researchers have extensively used Hofstede's model of national cultures to examine how culture impacts the acceptance of ICTs (Andoh-Baidoo, 2017). The Hofstede model comprises five dimensions: power distance, the balance between individualism and collectivism, masculinity and femininity, the approach to uncertainty avoidance, and the consideration of long-term perspectives versus short-term orientation. Within the framework of the technology adoption model (TAM), scholars apply Hofstede's cultural dimensions to investigate the impact of cultural variations on technology adoption (Kaba & Osei-Bryson, 2013; Lee et al., 2013; Olasina & Mutula, 2015). However, Pahl-Wostl et al. (2008) found Hofstede's framework limited in its analysis of culture and social learning as it describes culture by a few generalised dimensions. Hofstede has also been criticised for devaluing non-Western societies and idealising Western societies (Dimitrov, 2014).

In an African context, Hofstede's model is criticised for being descriptive, as African culture encompasses far more than what Hofstede described (Yavwa & Twinomurinzi, 2018). As a result, the authors consider Hofstede's five cultural dimensions to be inappropriate as predictors of individual behaviour. While researchers use the dimensions to predict behaviour at a national level, the dimensions are not suitable for understanding individual behaviour in the African cultural context (Yavwa & Twinomurinzi, 2018). Moreover, Hofstede's approach to culture is insufficient due to its static and generalising nature (Winschiers-Theophilus & Bidwell, 2013). To address the limitations of Hofstede's model, scholars suggest embracing "indigenisation theories" that consider the contextual factors of specific communities. This study considered Hofstede's model inappropriate to adequately explore the role of context specific knowledge systems that shape how technology is perceived, adopted, and implemented within resource constrained communities in an African context.

2.3.2 Digital adoption and usage

Avgerou (2017) contends that acknowledging the potential for ICTs to foster socio-economic advancements is crucial. However, attributing development outcomes solely to the diffusion of ICTs in a direct cause-and-effect manner is deceptive. This cautionary perspective emphasises the importance of considering the various contributing factors that impact development, rather than attributing it solely to ICTs. Moreover, it is crucial to acknowledge that ICTs could enable progressive or disruptive transformation in society. The progressive perspective enables socio-economic improvements through transfer, innovation, and locally situated action (Avgerou, 2010). According to Avgerou, locally situated action

> assumes the capacity of ICT to improve life conditions but sees the form and processes of improvements as being worked out primarily locally, according to historically shaped meanings and power relations. Its core argument is that socio-economic change should make sense to the local people, so they feel comfortable with the change processes (Avgerou, 2010).

Uys and Pather (2020) point out the gap between the anticipated benefits of ICT4D for marginalised populations in the developing world and the actual evidence supporting these expectations. In some cases, the negative consequences of digital activities manifesting as adverse digital incorporation can result in extractive vulnerabilities with the potential to harm marginalised communities (Heeks, 2022). Similarly, the integration of digital technologies raises significant concerns about inequalities, exclusion, insecurity, the vulnerability of local populations, and economic considerations (Mutsvairo et al., 2021). The connection between technology adoption and its socio-economic consequences must be examined holistically, taking into account the diverse ways in which digital tools can either exacerbate or alleviate existing inequalities. The authors challenge positive narratives and advocate for a holistic understanding of the multifaceted impact of digital technologies, emphasising the need to embrace diverse methodological approaches beyond the positivist paradigm. The non-prescriptive approach, which involves concentrating on specific actions that can foster the favourable economic, organisational, political, social, and cultural conditions necessary for digital technologies to unleash their transformative capabilities offers an alternative approach that is non-deterministic (Ndemo & Weiss, 2017).

A critical examination of the cause-and-effect phenomenon are crucial for understanding the limitations of digital technologies and applications, and for moving toward a holistic understanding of how entities within a system affect each other while considering multiple perspectives. This is crucial for understanding the complexity of the socio-economic, cultural, infrastructural, and technological factors that shape the conditions enabling or constraining their access, utilisation, and perceived benefits of DT. Therefore, a holistic examination of usage and adoption as part of the "whole" instead of an isolated entity, provides insights beyond simplistic analysis that rely on TAMs and the unified theory of acceptance and use of technology (UTAUT) (Frans & Pather, 2021; Mannan et al., 2017; Miranda et al., 2016). The comprehensive analysis is critical to inform the design of tailored strategies to respond to the contextual realities of communities. The ICT4D progressive transformation suggested by Avgerou (2010) highlights

the significance of the interaction between technology, people, and its transformation in multiple domains of human activities depending on the local and contextual realities, an interaction that must be carefully examined to understand the socio-economic implications and how local communities shape and are shaped by digital technologies.

Digital technologies such as cloud computing, blockchain, robotics, data analytics, artificial intelligence (AI), the Internet of Things (IoT), and 5G are gaining increasing prominence across diverse industries (Gorain, 2022). These technologies present substantial opportunities for improving the quality of life in "smart villages" in rural areas (Gorain, 2022). For example, digital technologies, such as sensors, drones, and satellites, have led to a fourth agricultural revolution (Quayson et al., 2020). While digital technologies present significant opportunities, particularly in sectors like agriculture their integration must be inclusive and carefully managed to avoid exacerbating existing inequalities and ensuring local relevance. According to Marwala (2024), inclusivity in AI development is essential, as it goes beyond ethical concerns to also address economic and social justice. This is especially important in ensuring that technological adoption does not marginalise indigenous knowledge systems or local practices.

However, this very challenge also presents an opportunity to reimagine how these technologies can be leveraged to support and amplify local culture and knowledge systems, ensuring they are not sidelined but instead integrated into the digital transformation process. As observed by Alexander (2015), while many often view digital technologies as tools that destroy culture, they can also serve as powerful tools for cultural preservation and empowerment. At the micro-level, digital technologies enable communities to create, store, preserve, and share their cultural heritage, facilitating communication with and connections to the outside world (Beel & Wallace, 2020). Moreover, the digitisation process facilitates the connection of local knowledge with broader accessibility as digital resources become accessible to individuals beyond the immediate communities. In this context, understanding how communities interact with these technologies is crucial, which brings us to the concept of affordances.

To better understand how digital technologies influence socio-economic conditions, it is essential to explore the concept of affordances, which examines the interaction between individuals and their environment, shaped by local practices and contexts. Affordances encompass a system of human, social, and technical elements that, in diverse combinations, facilitate actions at different levels of detail (Bygstad et al., 2016). Affordances emerged from social practices involving technology and are related to the user's experience, skills, and cultural understanding, which are relational and situated (Zheng & Yu, 2016).

Moreover, for people to achieve affordances, pre-existing conditions must enable the process. Thus, affordance is the interaction between a goal-oriented actor and the environment, including the actor's and the environment's properties (Sein et al., 2019). In technology discourse, affordances illustrate how the tangible attributes of objects shape, direct, encourage, and restrict their potential applications (Markus & Silver, 2008). According to these authors, the affordances idea stems from the notion that individuals extract information relevant to their requirements from the objects in their surroundings, representing the affordances of those objects rather than their inherent properties.

Consequently, affordances are unique to each actor, meaning that what constitutes an affordance for one actor might be irrelevant to another. For example, during the global COVID-19 pandemic, individuals relied on access to ICTs,

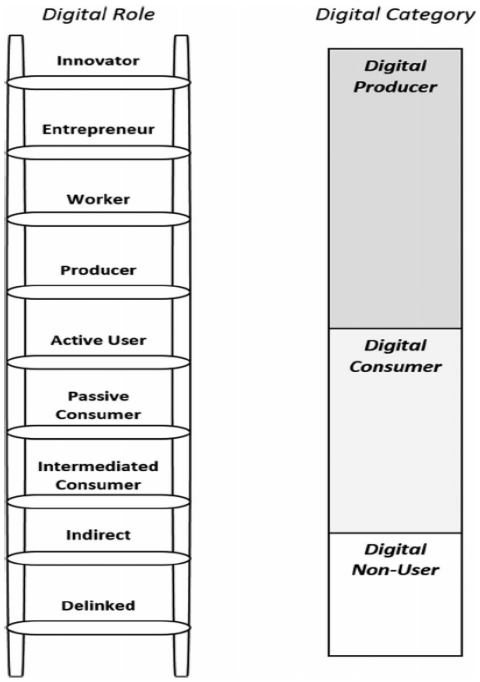
especially connectivity, as a critical tool for survival (Frans & Pather, 2021). Moreover, users recognise and realise affordances based on their interaction with the system in the specific context of use (Pozzi et al., 2014). While affordances explain how digital technologies facilitate action, the broader socio-economic context in which these technologies are embedded must be understood to ensure their success. Furthermore, goals influence people and guide them through implicit suggestions embedded in tools that support perception, thought, and action (Carvalho & Yeoman, 2018). Expanding on this understanding of technology and human interaction, Mavhunga (2014) describes technology as "nzira" (a way of doing) and as a method of accomplishing specific tasks or objectives by mastering a set of practices known as "unyanzvi", which encompasses a combination of spirit, talent, skills, and knowledge. Therefore, understanding the dynamic interaction between digital technologies, local practices, and socio-economic contexts is essential for harnessing the transformative potential of ICTs for communities in resource-constrained environments in an African context.

2.3.3 Digital skills for the 21st Century

Success in DT relies on both technology and human input (Mutsvairo et al., 2021). Consequently, people require practical knowledge and wisdom to make well-informed decisions in uncertain situations (Schiuma et al., 2021). Skilled and capable people are critical inputs into the digital revolution, serving as both users and producers (van Laar et al., 2022). In the context of expanding capabilities and empowering individuals to acquire 21st-century digital skills, the Heeks digital roles ladder illustrated in Figure 2.7 provides a valuable framework for understanding the evolving nature of digital skills and participation in the digital economy. The ladder signifies increasing levels of engagement with digital technology, progressing from no direct use to direct use that qualifies as part of the digital economy. However, rural people remain at the bottom of the ladder of digital roles and largely as passive prosumption (Heeks, 2020). For instance, basic digital literacy programmes may be suitable for those at lower rungs, while more advanced technical training may be necessary for individuals aiming to become active producers or platform creators. Heeks (2020) highlights that in developing countries, individuals adopt various roles when interacting with digital technologies. Understanding where individuals or communities fall on the ladder could unlock the design and implementation of transformative capacity-building interventions that do not only seek to produce competent consumers of digital services and products.

The shift from industrial production to knowledge creation driven by globalisation and the pervasiveness of technology requires a combination of digital and 21st-century skills that include core and contextual (van Laar et al., 2022). Core 21st-century digital skills encompass fundamental abilities such as technical proficiency, information management, communication, collaboration, creativity, critical thinking, and problem-solving. Contextual 21st-century digital skills involve understanding and navigating the legal, ethical, and cultural aspects of ICT use, adapting to changing digital environments, setting and managing personal goals in ICT usage, and continually exploring new opportunities for learning and knowledge creation through ICT, emphasising a holistic approach to digital competence.

Figure 2-7: Heeks 's digital role ladder



Note: Heeks's digital roles ladder outlines different levels of participation in digital activities, ranging from basic consumption to advanced production and innovation (Heeks, 2020, pp. 9).

Digital skills encompass a range of abilities needed to effectively use digital technologies, access and manage information, communicate, collaborate, problem-solve, and navigate the digital world (Alharbi et al., 2023). Digital skills can be categorised into automation, structural, and strategic skills (Alharbi et al., 2023). Automation skills involve the operational manipulation of technology for operating hardware, software, and networks. They include information handling and content creation, essential for acquiring and using innovative technologies and software in various contexts. Structural skills concern the cognitive aspect of information and the ability to create cognitive schemas to solve problems. Strategic skills involve using resources to achieve objectives, which includes proactively searching for information to make informed decisions based on data. van Laar et al. (2020) postulate that digital literacy goes beyond mere technical skills, it encompasses the ability to comprehend and effectively utilise information from various digital sources. The ladder emphasises a progression from basic consumption to advanced production and innovation. This highlights the importance of lifelong learning and developing digital skills to actively engage in the digital economy beyond passive and active consumerism.

After discussing the significance of digital skills in fostering participation and engagement in the digital economy, it is important to consider how these skills can be enhanced through broader frameworks that emphasise human empowerment and capability development. In this context, the CA offers a compelling lens to address the shortcomings of ICT4D initiatives, particularly by focusing on the expansion of individual and collective freedoms to access and use digital technologies. Scholars such as Yim and Gomez (2021) highlight the need for a transformation in capabilities, which can be pivotal for leveraging digital technologies in a way that supports

sustainable development. Scholars recommend the use of the capability approach to address the shortcomings of ICT4D (Bahr & Luse, 2024; Sein et al., 2019; Yim & Gomez, 2021). Yim and Gomez (2022) define CA as "a process of expanding the real freedoms that people enjoy" and focus on the expansion of the capabilities of persons to lead the kind of lives they value. The five core components of the CA, as explained by Bahr and Luse (2024), are:

1. **Resources**: These are the goods and services available to individuals that enable human development.

2. **Opportunity freedom**: This involves expanding people's choices and access to resources to allow them to achieve their desired life outcomes.

3. **Process freedom**: This refers to empowering individuals to actively engage in the development process as agents, rather than being passive recipients of aid or benefits.

4. **Functionings**: These are the actual outcomes of human development that result from the capability options selected, such as employment, safety, and well-being.

5. **Conversion factors**: These determine how resources are converted into opportunities and processes for development within specific contexts, influenced by personal characteristics, social arrangements, and environmental conditions.

Yim and Gomez (2021) suggest that technology enables and transforms, aiding in attaining valued capabilities. However, the literature review indicates divergent viewpoints about the relationship between technology and the core elements of the CA approach (Haenssgen & Ariana, 2018). Scholars criticise the CA for being under-theorised, focusing on the individual, having a pre-defined list of capabilities, and Sen's reluctance to address power relations, despite its offering a holistic and non-prescriptive approach (Egessa et al., 2020; Loh, 2015; Roberts & Poveda, 2018).

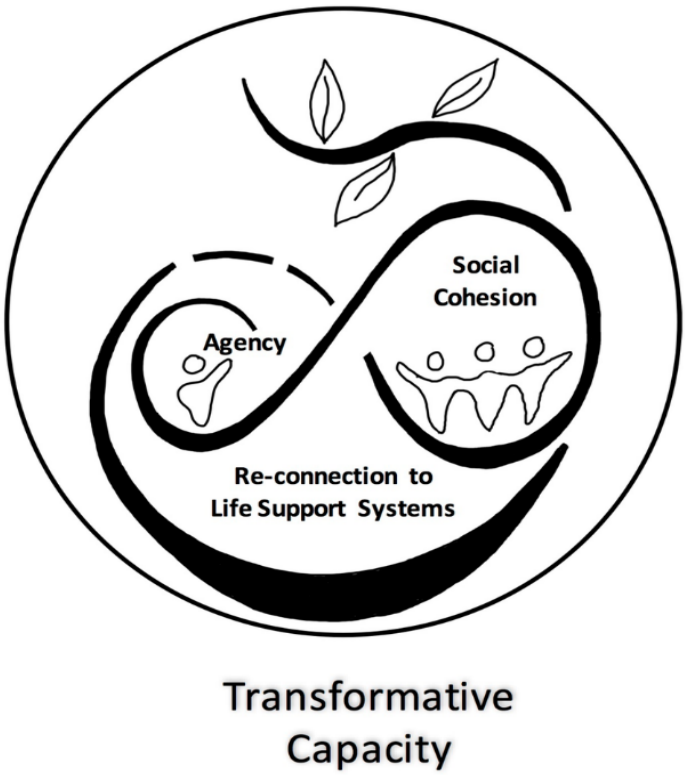
In response to the gaps associated with the individualist focus of the CA, scholars advocate collective capabilities as fundamental contributors to creating localised solutions (Thapa et al., 2012). Collective capabilities consider the importance of the collective abilities and capacities of communities in promoting a more inclusive and community-centric approach when seeking tailored solutions. Collective capabilities or actions are the output of community agency (Matarrita-Cascante et al., 2010). Community agency is a process of building relationships that increases the capacity of local people to unite, act, and adapt to changing conditions, as well as to identify common needs and the means to address them. In Nepal, social capital and collective actions have enhanced both individual and collective capabilities (Thapa et al., 2012). However, while community agency produces action and collective capabilities, it is essential to note that agency and structure intertwine and shape each other (Coelho et al., 2015). Structures provide the context and constraints within which an agency operates. The agency has the potential to shape and transform the structure through individual and collective actions. Furthermore, the interplay between structure and agency recognises that individuals are active participants who can exert influence and bring about change, rather than passive recipients of societal structures. Agency is the capacity of individuals to initiate actions and intentionally influence events (Bandura, 2006). There are four core properties of agency ; intentionality, forethought, self-reactiveness, and

self-reflectiveness, which empower individuals to plan, execute, and regulate their actions while considering the reasons and outcomes (Bandura, 2006).

Beyond the core properties of agency, two other modes of agency are proxy agency, where individuals act through others as their agents, and collective agency, which highlights the capacity of groups and communities to collaborate and shape events. Bandura (2006) and Coelho et al. (2015) acknowledge the influence of social and socio-cultural contexts on agency. Bandura emphasises that agency is built on individuals' social-cognitive capacities and preparedness, recognising that humans possess the cognitive abilities and social awareness necessary to exercise agency. Similarly, Coelho et al. (2015) highlight the enabling environment created by structures such as policies, laws, and institutions that support specific programmes or initiatives.

This understanding of agency is further enriched by Ziervogel et al. (2016), who position it within the broader context of transformative capacity. They highlight how agency, in tandem with social cohesion and re-connection to life support systems, plays a critical role in community development and resilience, as illustrated in Figure 2.8. Agency as the capacity of individuals to initiate actions and influence events intentionally. Social cohesion refers to the collective capacity of communities to collaborate towards common objectives, fostering strong social bonds and a sense of community. Re-connection to life support systems emphasises understanding and respecting natural systems, promoting self-sufficiency, and shifting paradigms towards collaborative co-creation.

Figure 2-8: Transformative capacity encompassing the three domains



Note: This figure illustrates the domains of transformative capacity: agency, social cohesion, and re-connection to life support systems as discussed by Ziervogel et al. (2016).

Ziervogel et al. (2016) implemented the transformative capacity framework through the Fostering Local Wellbeing (FLOW) programme, which aimed to build adaptive and transformative capacity in communities. Their study found that by integrating the domains of transformative capacity into community development initiatives, communities were better equipped to address challenges and foster resilience. Similarly, in DT, integrating agency, social cohesion, and re-connection to foundational systems has the potential to enhance the collective capacity to navigate and thrive amidst technological changes. Collective capabilities and agency in ICT4D are crucial for understanding the role of deeply embedded practices such as communalism in facilitating rural DT in resource-constrained environments. Therefore, allowing communities to be agents of their DT is essential (Breytenbach et al., 2013). This view aligns with Ye et al.'s (2021) observation about the agency of rural communities in China in engagement with citizen-led DT. In conclusion, empowering communities to engage with digital technologies through collective capabilities and agency actively is essential for ensuring that rural areas can navigate and benefit from digital transformation in ways that align with their values and needs.

2.3.4 Digital infrastructure

An examination of digital platforms in the context of ICT4D reveals a multifaceted landscape concerning power dynamics and the exploitative practices of Western nations (Bonina et al., 2021). Understanding the critical role of infrastructure in unlocking collective capabilities, facilitating inclusive adoption and usage, developing digital skills, and tailoring contextual digital solutions is essential. As discussed by (2024.p.15), "success in the digital economy depends on who owns and manages its infrastructure and data. The digital economy benefits certain businesses, nations, and cultural sectors more than others." ICT contributes primarily to individual-level human development in developing countries, with minimal impact on economic and social aspects (Zelenkov & Lashkevich, 2023). The dominance of the Global North gives rise to discussions about data colonisation, monopolies that hinder local platforms from participating in the DKE ecosystem, and the flow of profits generated in the Global South back to the Global North. Notably, Western tech giants like Facebook, Google, Uber, and Netflix wield significant control over Africa's digital infrastructure and ecosystem (Birhane, 2020).

While ICT services, products, digital platforms, and broadband penetration consumed through ICT4D contribute to a country's gross domestic product (GDP) (Maggi et al., 2018; Pradhan et al., 2017), focusing solely on GDP disregards well-being (Ganju et al., 2016). Moreover, while the contribution of ICTs to GDP is acknowledged, ordinary communities are often relegated to the roles of consumers and knowledge workers, excluded from active participation in GDP generation (Singh et al., 2018). The authors argue that it is imperative to understand how ICT can improve individuals, communities, or nations by tracing their activities before introducing ICTs and transforming their practices. While developing and less developed countries are encouraged to leapfrog, past attempts to close the poverty gap in sub-Saharan Africa by catching up with technologically advanced nations have proven futile (Ikejiaku, 2009).

A robust mobile network, infrastructure, and adequate Internet are prerequisites for DT and, consequently, for the digital economy to thrive. However, Javaid et al. (2024, p.15) observed that "there is a difference between people with access to technology and those without access. The divide is not just between countries but also inside them. This has led to the emergence of a new kind of inequality worldwide." Hosman and Fife (2012) postulate that without proper connectivity, the transformative potential of ICTs remains untapped, hindering progress in various developmental aspects. Additionally, while mobile phones are essential tools for bridging the digital divide, relying solely on them to lead the African continent to economic growth is not a satisfactory approach (Hosman & Fife, 2012). \

Pfotenhauer et al. (2023) posit that attempts to engage in the global innovation economy involve adopting established models, such as research clusters, technology parks, and ecosystem blueprints, focusing on renowned innovation hubs like Silicon Valley or the Massachusetts Institute of Technology. However, the authors caution that imported models often experience more failures than successes in different contexts and suggest adopting a contextual and bottom-up understanding of innovation, recognising and valuing cultural dynamics, including local values, socio-economic legacies, and political cultures. In response to challenges such as digital colonisation and power dynamics, the literature highlights the crucial need to consider approaches like globalisation from below and localisation. Globalisation from below is an alternative and non-hegemonic approach that advocates economic activities that emerge organically from local communities (Ribeiro, 2006). In the context of ICT4D, globalisation from below entails deploying and using ICTs that originate in local communities, aligning with their specific needs, aspirations, and socio-cultural contexts. However, it is crucial to understand that true localisation considers the targeted locale's language, culture, customs, and technical characteristics (de la Cova, 2021).

In addressing these disparities, CNs and Living Labs have emerged as innovative approaches to democratizing access and fostering digital transformation. CNs provide grassroots solutions to connectivity challenges, enabling local ownership and control of infrastructure (Castignani et al., 2011). In parallel, Living Labs offer user-centric methodologies for co-creating solutions tailored to real-life contexts (Compagnucci et al., 2020). Walt et al. (2009) describe a Living Lab as a new way to deal with community-driven innovation in real-life contexts, fuelled by knowledge sharing, collaboration, and experimenting in open environments. In South Africa, the Siyakhula Living Lab offers different services to the community, including ICT, software applications, e-services, empowerment, and engagement. However, Coetzee et al. (2014) caution that the Living Lab approach does not involve using end-users as guinea pigs for experiments but rather empowers them to be equal partners in the innovation process, enabling users to become active collaborators in the development of solutions. In the Living Lab ecosystem, innovation goes beyond high-technology products; it focuses on co-creation, enabling target users to connect with technological solutions that align with their perspectives (Habiyaremye, 2020). Furthermore, rural Living Labs (RLL) can play a role in preserving and promoting tangible and intangible cultural heritage (Zavratnik et al., 2019).

Together, these models CNs and Living Labs represent critical pathways for overcoming digital inequalities and providing appropriate infrastructure. Historically, technologies in Africa and other societies have been integral to

the value systems that conceived them (Ishemo, 2004). For instance, Johnson et al. (2012) examined network traffic patterns in the Macha CN, revealing that users in the same locality often engage in significant local data sharing and social interactions. Similarly, Bidwell (2020) highlights the contribution of CNs in fostering social cohesion in communities that have faced turmoil due to conflicts. CNs promote digital skills and knowledge exchanges rooted in traditional learning approaches, such as Wangoo, an Acholi cultural practice involving storytelling around the fireplace. Therefore, addressing digital inequalities requires a paradigm shift toward inclusive and community-driven approaches.

2.3.5 Digital leadership: Macro, meso and micro-level perspectives

The preceding sections indicate that ICT4D is part of the globalised DKE. Consequently, it is integrated into the global economic structures shaped by the epistemologies and ontologies of the actors involved in the ecosystem (Rau et al., 2008). This section focuses on leadership perspectives by examining how the epistemology and ontology of digital leaders shape and influence the nature of ICT4D and digital transformation (DT) at the macro, meso, and micro levels. The interconnectedness of macro-level global power dynamics, meso-level institutional frameworks, and micro-level community engagement underscores how digital transformation in ICT4D is shaped by both top-down policies and bottom-up participation. This highlights the need for leadership that considers the complexities and agency at all levels of the ecosystem. Therefore, the analysis of macro-level leadership is critical for understanding how the beliefs and worldviews of leaders shape decisions and actions related to human capacity building, the adoption and use of digital technologies, the development of digital skills, the establishment of infrastructure, and the design of contextual digital solutions. It is essential to understand digital leadership dynamics beyond simplistic factors such as vision and strategy. As discussed by Abubakre and Mkansi (2022), examining macro-level contextualisation provides insights into the societal conditions influencing the broader ICT4D landscape.

Moreover, historical factors and biases shape the perception of technology transfer to Africa, reinforcing power dynamics that favour external sources, particularly those from the Northern hemisphere (Mavhunga, 2014). These narratives overshadow indigenous innovation, perpetuating stereotypes of Africa as merely a recipient rather than a source of technological creativity. This perception persists, especially as the Global South is increasingly seen as the battleground for superpower conflict between China and Western powers, often described as a “digital cold war” (Heeks et al., 2024, p. 86). As power shifts into the digital space, this dominance extends not just through physical means but through more subtle, algorithm-driven mechanisms that reflect the ideologies of the creators themselves.

Kwet (2019) discusses the concept of “digital colonialism,” drawing a parallel to the historical “Scramble for Africa.” In this context, dominant multinational companies extract, analyse, and assert ownership over user data for financial gain and to increase market influence. In the era of algorithms, power dynamics manifest not only through overt physical force but also through subtler means, such as the manipulation of digital ecosystems and infrastructure (Birhane, 2020, p. 391). This phenomenon, known as algorithmic colonialism, involves the domination, surveillance, and influence over social, political, and cultural discourse by controlling key communication and infrastructure channels. Furthermore, the “digital men of power” are emerging; they own and control information vectors,

maintaining their dominance by enforcing information asymmetries and corresponding legitimating ideologies (Timcke, 2020). According to Timcke (2020), what ordinary people interact with through digital technologies and what these technologies produce is not merely a matter of programming or coding but reflects ideology and epistemology.

Moreover, the algorithms used in digital technologies are not just data but represent the ideologies of the actors behind them. In this way, algorithms express epistemology through digitalisation, a process shaped by the ideologies of the creators. As observed by Heeks et al. (2023), there is a need to move from organisational (macro-level) to micro-level perspectives to explore how individuals experience and participate in digital transformation in development settings. The authors suggest that researchers critically assess the actors influencing the current discourse on digital transformation, examining the interests of those benefiting from it and how these interests shape the broader development agenda. To minimise epistemic violence, community participation is often employed, though there is no consensus on what participation entails. Kim and Lee (2023, p. 158-159) observe that the definition of participation varies significantly, influenced by theoretical approaches and understood through different levels of engagement and empowerment within decision-making processes, as illustrated in Figure 2.9.

Figure 2-9: Typology of participation illustrated by Kim and Lee (2023)

	Theoretical Frameworks			
Level	Arnstein (1969): Ladder of participation	Peruzzo (1996): Levels of participation	Gaventa (2018): Spaces of participation	Typology adopted for this study
First level	Non-participation	Non-participation	Uninvited space	**Participation as Access**
Second level	Tokenism	Controlled participation	Invited space	**Participation as Empowerment**
Third level	Citizen power	Power participation	Claimed/created space	**Participation as Social Justice**

Note: This figure illustrates the different levels of participation within decision-making processes, ranging from minimal involvement to significant empowerment (Kim and Lee, 2023, p. 144).

While participatory discourses have evolved since the 1960s, the fundamental dynamics of power and authority in decision-making processes remain relatively unchanged. Within ICT4D and the context of the modernisation paradigm and neoliberalism, participation tends to be linked with concepts like access and empowerment, often narrowly defined within existing hegemonic structures, rather than with broader notions of social justice. Kim and Lee (2023) argue that genuine participation extends beyond mere access and connectivity, asserting that for participation to hold significance, ICT infrastructures and networks must align with social and contextual norms. For example, rural communities in China actively engage in citizen-led information practices, harnessing local resources and cultural strengths to foster their development (Ye et al., 2021). Their findings indicate that micro-level actors are not passive recipients but actively seek, use, and share information.

In the context of South Africa, community-based learning, ICTs and quality of life (CLIQ) implemented in rural Kwa-Zulu Natal applied participatory rural appraisal (PRA) tools such as storytelling, community, and household maps as well as individual five-year plans as part of their strategy to understand the local context, individual aspirations, communication and information needs and what they perceive to be a quality of life (Nicholson et al., 2011). Design thinking is another participatory approach applied in ICT4D (Smith & Lie, 2023). While these approaches have made strides in incorporating community participation, there's still a challenge in implementing inclusive, participatory interventions that treat people as capable beings with the agency to self-determine in the DT.

Therefore, examining the epistemology and ontology of digital leaders is critical for this study, as it highlights the interconnectedness of ICT4D and ontological and epistemological stances, which locates digital technologies within historical and socio-cultural narratives

2.4 Reframing ICT4D narratives and embracing the "other"

Recently, a call has been made to reframe "development" in terms of justice, the potential of multi-theoretical research approaches, and the turn to indigenous understandings of ICTs to address the well-documented ICT4D weaknesses (Masiero, 2022). Scholars posit that implementing ICT4D requires the application of multiple perspectives and tools to adequately engage with its interdisciplinary nature and the complexity of the environment in which projects and research are conducted (Heeks & Renken, 2018; Masiero, 2022). Embracing indigenous knowledge systems and holistic theories, alongside incorporating local ontologies and epistemologies, is highlighted as crucial for contextual relevance and sustainable impact (Masiero, 2022; Mthoko & Khene, 2018; Srinivasan, 2013). Masiero (2022) advocates for "indigenous theories" as one of the interdisciplinary approaches to better frame the role of technology in developing countries. People's ways of doing and knowing are considered systems of knowledge, now referred to as IKS (Ishemo, 2004). People's ways of doing and knowing are considered systems of knowledge, commonly referred to as Indigenous Knowledge Systems (IKS), which encompass bodies of knowledge that are localised and unique to specific cultures or societies (Ishemo, 2004; Tharakan, 2015).

Building on these perspectives, the call for indigenous theories represents a paradigm shift in understanding and leveraging ICTs within diverse contexts. Rather than relying solely on traditional development frameworks, indigenous theories encourage researchers and practitioners to prioritise locally grounded worldviews, cultural values, and community-driven insights when designing and implementing ICT4D initiatives. This approach challenges the often Western-centric paradigms that have historically dominated development discourse, fostering greater inclusivity and relevance in addressing the socio-economic and cultural complexities of developing countries. Mutsvairo et al. (2021) postulate that expanding digitalised technologies should support and not suppress existing indigenous knowledge mechanisms. The authors highlight the need to examine the broader economic and social contexts in which modern technologies become embedded in African societies, as conflicting forces often shape the technologies. Additionally, Ishemo (2004) and Srinivasan (2013) posit that digital innovations must be rooted in local ontologies and the values of the people to be successful.

Furthermore, scholars agree that IKS is a politically loaded concept that seeks to marginalise communities that operate outside of the Eurocentric ways of being and doing (Ishemo, 2004; Okere et al., 2005; Tharakan, 2015; Vhurumuku & Mokeleche, 2009). Although it is agreed that IKS is context-specific, it embraces the essence of the ancestral legacies of diverse histories and cultures. Scholars who reject the concept of IKS argue that all knowledge is first local and culturally rooted, whether indigenous or not (Okere et al., 2005). This perspective aligns with the concept of knowledge pluralism, which, as defined by Hoelting et al. (2024), acknowledges multiple, valid ways of knowing and understanding reality. Knowledge pluralism stresses the legitimacy of different knowledge systems, emphasising that diverse cultural, historical, and contextual factors shape how people come to understand the world around them. Indigenous theory is a "theory of human behaviour or mind that is specific to a particular context or culture" (Davison & Andrade, 2018). It is deliberately designed for the people who live in that context or culture. For instance, Ubu-NTU is one of the African "indigenous theories" that scholars use in interdisciplinary studies to contextualise ICT4D to address the epistemic violence driven by Eurocentric worldviews (van Stam, 2012). Expanding on this perspective, Van Stam (2021) proposes a paradigm shift from colonially framed cultural frameworks (an individualistic ("I") approach) towards communal understandings of reality (a collective ("We") approach), aligning with the principles of Ubu-NTU philosophy. Masiero (2022, p. 11) also asserts that Ubu-NTU plays a role in contextual innovation and may be "useful to understand contextual dynamics that Western theories may be unable to conceptualise," further supporting Van Stam's argument.

ICT4D scholars contribute to contextualisation by examining cultural frameworks such as Ubu-NTU. Several researchers employ Ubu-NTU and its attributes such as relationality, kinship amongst others, in the contextualisation of digital innovations (Abubakre & Mkansi, 2022; Bidwell, 2010; Sheneberger & van Stam, 2011; Twinomurinzi et al., 2010). Abubakre and Mkansi (2022) explored the significance of kinship affiliations as a motivating factor for digital technologists in Gauteng, engaging with disadvantaged communities. The authors explored non-genealogical kinship as an indigenous value system that plays a significant role in most South Africans' daily lives. Their study found that kinship was a core value that influenced how South African digital technologists saw their role in improving people's well-being. In a different study, Abubakre et al. (2021) observed tensions between the principles of Ubu-NTU and the competitive and innovative mindsets of entrepreneurs, highlighting that Ubu-NTU is not a static value system as it can serve as both an enabler and a constraint. Bidwell (2010) explored the impact of the Ubu-NTU philosophy on identity and social capital in the Eastern Cape. The study revealed that Ubu-NTU was crucial in shaping the villagers' understanding of identity and social relationships. According to Bidwell (2010, p. 69) "ancestry, language, and clan were significant aspects of their identity construction, as many villagers could trace their lineage back at least eight generations to the area's settlement by a chiefdom descending from a distinct Xhosa tribal cluster."

Twinomurinzi et al. (2010) investigated the integration of the Ubu-NTU philosophy into e-government initiatives in South Africa and its potential implications for development. The study's findings revealed that aligning e-government with the principles of Ubu-NTU could lead to a more culturally relevant and inclusive approach. In a different context, Yavwa and Twinomurinzi (2018) explored how indigenous culture, particularly spirituality, communalism, and

respect for elders and authority, influenced the adoption rate of e-government services in Zambia. Beyond ICT4D, scholars in the fields of business, psychology, and leadership studies use Ubu-NTU. For instance, Sarra and Berman (2017) noted that Ubu-NTU has the potential to enhance people's economic capabilities during times of adversity and can serve as a tool for resilience for businesses in South Africa to raise capital. This offers an alternative approach to financing micro- and small businesses compared to the Western-style models proposed by international lending organisations, which prioritise shareholder primacy, short-term profit, and the privatisation of public goods. Sarra and Berman's observation aligns with Sheneberger and van Stam's (2011) findings concerning the relatio economy, grounded in the philosophy of Ubu-NTU in the Zambian context. Relatio economy differs from traditional Western economic models. Instead of relying on formal banks and credit evaluations, the relatio economy stresses the importance of social connections in economic exchanges.

Manyonganise (2015) asserts that the foundational principle of Ubu-NTU is that traditional African societies organise themselves around the essence of being human through other people. Ewuoso and Hall (2019) trace the origins of Ubu-NTU back to the pre-colonial era and highlight its prominence in post-apartheid South Africa, placing it within the broader genre of African ethics. At the same time, there are important considerations regarding the scope and applicability of indigenous theories. Davison and Andrade (2018) caution against the universal application of "indigenous theories", stating that theories developed in one context may not be suitable or applicable when transferred to different contexts due to variations in cultural and economic settings. Therefore, theoretical explanations of specific behaviours should vary to ensure accuracy at the local level. This underlines the intricate challenges of navigating meaning and understanding, especially when taking a universal approach to integrating indigenous concepts across diverse settings. For instance, the varying interpretations and applications of the philosophy of Ubu-NTU across different disciplines have given rise to a wealth of writings and sparked considerable debate among scholars (Ewuoso & Hall, 2019). These debates are further complicated by the broader historical and social transformations.

Pityana (as cited in Munyaka & Motlhabi, 2009) indicates that moral rules are not static as colonisation, apartheid, and urbanisation have weakened the family structure and facilitated the adoption of Western ways of doing and being, which has affected Ubu-NTU. Consequently, the cohesive and unified sense of community, a defining aspect of African culture, was negatively impacted to a certain extent and lost its essence. The role of family is crucial in Ubu-NTU, as strong families serve as the foundation of communities. Similarly, Ewuoso and Hall (2019) posit that a fragmented community results in individuals who are emotionally and spiritually wounded, underscoring the imperative for healing and rejuvenation at both the communal and personal levels. Nurturing close-knit family relationships is essential for promoting Ubu-NTU values and contributing to the resilience and supportiveness of communities (Mabovula, 2011).

The arrival of colonists, traders, and missionaries in African societies resulted in significant cultural transformations, introducing foreign beliefs, systems, and practices that gradually eroded the essence of Ubu-NTU, leading to a clash between traditional African values and external ideologies (Dolamo, 2013). Furthermore, factors such as poverty,

high crime rates fostering fear and mistrust, lack of trust among community members, and the influence of foreign cultures conflicting with traditional values hinder Ubu-NTU (Mabovula, 2011). These challenges, compounded by societal dysfunctions, create a context where the application of Ubu-NTU becomes increasingly difficult. For instance, Ubu-NTU faces substantial obstacles when applied in African contexts, as evidenced by corruption, human rights abuses, and gender-based violence (GBV) (Magezi & Khlopa, 2021). On the other hand, Bolden (2014) indicates that there might be contradictions between Ubu-NTU's ideals and the reality of social, economic, and political inequalities. According to Bolden (2014, p. 801), "Ubu-NTU might overlook the connection between people and the environment, focusing solely on human relations without considering ecological and spiritual aspects." The identified complexities challenge the universal approach to Ubu-NTU as a panacea for solving societal challenges. Therefore, examining what is enabled or constrained by Ubu-NTU is critical. This cautious approach warns against a universal approach and highlights the need for context-specific considerations.

2.4.2 Beyond ICT4D Ubu-NTU: African thought system of interconnectivity

The previous discussion offers valuable insights into the opportunities, tensions, and complexities that emerge when integrating Ubu-NTU principles into ICT4D and other sectors of society. In contrast to the universalisation of Ubu-NTU as an African philosophy, there is a call for a comprehensive understanding of African philosophy beyond just Ubu-NTU, as cautioned by Letseka (2013). According to the author, Ubu-NTU is not synonymous with African philosophy, and cultural practices and traditions do not fully represent the entirety of African philosophical thought. The cautionary stance provides a valuable lens to critically assess the application of Ubu-NTU in ICT4D to mitigate the risk of oversimplifying Ubu-NTU or the separation of Ubu-NTU from the whole and interconnectedness of African ways of knowing, being, and doing. While Ubu-NTU is an essential part of African philosophy, Letseka (2013) emphasises that African philosophy is a broader and multifaceted discipline. In this broader context, Tempels (1959, as cited in Imbo, 1998) views philosophy as a collective expression of a culture drawn from observations of the behaviour, customs, and language of the Bantu people. Building upon Tempels' ideas, Kagame a prominent philosopher and scholar[7] (as cited in Imbo, 1998), studied the Kinyarwanda language to reveal underlying philosophical concepts in the Bantu worldview, focusing on categorisation and the role of intelligence as a foundational element in Bantu philosophy. According to Imbo (1998), Kagame identified four fundamental categories of NTU ways of being in the Bantu worldview, based on the distinct word classes found in Bantu languages:

- Umu-NTU refers to human beings and highlights their unique capacity for intelligence, setting them apart from other entities.

[7] Abbé Alexis Kagame was a Rwandese historian, ethnologist, and philosopher, who became the intellectual leader of the Tutsi people by articulating their cosmology in contemporary terms. https://dacb.org/stories/rwanda/kagame-alexis/

- Iki-NTU encompasses non-human beings and inanimate objects which lack intelligence and are considered subordinate to humans.
- Aha-NTU represents places and time, emphasising their significance in shaping Bantu thought.
- Uku-NTU relates to quantity, covering numerical aspects and measurement.

While Kagame's work contributes significantly to understanding Bantu philosophy through linguistic analysis, it has been critiqued for imposing Aristotelian categories on African thought, thus oversimplifying the diversity of African worldviews and overlooking the unique cultural contexts of different African societies (Ukwamedua, 2011). Therefore, it is crucial to understand Ubu-NTU philosophy as one of the dominant theories of indigenisation in ICT4D, moving beyond simplistic interpretations to a more holistic understanding of African philosophy and the dynamic interplay between ontology, epistemology, and language in DT. Ramose (2005) posits that African ontology and epistemology have their roots in Ubu-NTU. According to Ramose, Ubu-NTU is the fundamental basis of African philosophical thought; it is not just a philosophical concept related to existence. Additionally, Ubu-NTU philosophy considers Umu-NTU (the human being) as the embodiment of the ontology and epistemology of UBU- (the broadest and all-encompassing being). Moreover, the philosophy is deeply intertwined with how knowledge is perceived and acquired. As Ramose (2005, p. 36) breaks it down, "Ubu-NTU is a compound word composed of UBU and NTU. UBU encompasses the concept of Being in general, while NTU pertains to an entity's specific and concrete form. UBU may be seen as the fundamental essence of existence, with a focus on ontology.

NTU represents the specific manifestation or form of existence, emphasising its ongoing evolution and understanding, which leans towards the epistemological aspect." Furthermore, Ubu-NTU is not a static concept but rather a dynamic force, constantly evolving and embodying a sense of continual motion. Additionally, Ramose (2005) highlights the fundamental role of language in shaping the perception of reality. In line with this, Bohm (1983, as cited in Ramose, 2006, p. 80) posits that the rheomode language takes the verb as its point of departure instead of the subject-verb-object, which imposes a separation between the doer and the doing. Building on Bohm's perspectives, Ramose posits that the rheomode offers a holistic understanding of how entities shape each other in the processes of becoming, emphasising their relationship. "The conventional structure of language, with its subject-action-object framework, can oversimplify the view where individuals perceive themselves as actively shaping the world" (Ramose, 2005, p. 40). Moreover, Ramose cautions against the separation of being from doing, arguing that focusing solely on the doer's role risks neglecting the interconnectedness of doing and being, leading to the fragmentation of existence into isolated descriptions. His caution reflects the pluralistic nature of existence in African philosophy, advocating for a holistic view in which doing and being are not separate but are inextricably linked in a continuous, dynamic process.

Zulu (2013) likewise reinforces the importance of language in shaping reality, as well as the interconnection between doing and being in the Basotho ontology. Zulu's contribution to the field of African philosophy reveals that the Basotho people employ Tho, Mo, Thu, Teng, and Beng to describe various ontological states. According to Zulu, the prefix Mo represents the state of being, which can manifest as a material state, a physical state, a spatial state, a spirit

state, or a default state of being. Mo is an ideal state. The suffix Tho (Mo-Tho, similar to Umu-NTU) introduces the notion of spirit beings, highlighting the spiritual and metaphysical dimensions inherent in human existence. According to Zulu, an ideal state does not allow any type of constraint like contradiction, denial, or negation. Building on this, Zulu introduces the concept of Yena, which represents the being in its ideal state, free from any constraints, empowering the individual to shape their own destiny. "Yena (the being) is supposed to be free from constraint so that Yena is inspired, empowered, and anchored in this ideal state of being and in this way, to make it necessary and possible for the being to design, own and direct the destiny of Yena" (Zulu, 2013, p. 10). The perspectives on the ontology of Basotho are supported by Mahlatsi (2017), highlighting that the term Botho originates from the Sesotho language, consisting of the prefix BO and the suffix THO. BO is identical to the prefix UBU and THO is identical to the suffix NTU in the isiZulu language, as observed by Ramose (2005).

This understanding of language and being as interconnected is also reflected in other aspects of African culture, such as the Yorùbá Bàtá drums, which embody the very essence of African philosophy in practice. In this broader context, African philosophy encompasses spiritual, material, spatial, and temporal modalities of being, and how language shapes reality. For example, the Yorùbá Bàtá drums embody the interconnectedness of African philosophy, as observed by Villepastour (2010). According to the author, the Yorùbá Bàtá drums work as a telegraph without wire and the Ena language works as a code that transmits data over kilometres to be decoded by the recipients. The Yorùbá drums transcend their musical function, serving as essential tools for cultural preservation, language expression, social cohesion, and spiritual significance (Oluga, 2012). The Yorùbá Bàtá drum system further exemplifies the principle of pluralism by operating as a communication network that blends spiritual, social, and cultural dimensions. The drum network operated through an autonomous system of drums communicating with each other via a relay system. The relay system enabled messages to propagate as wave signals, much like modern communication technologies, such as Wi-Fi, transmit data signals (Zulu, 2013).

The Yorùbá Bàtá drum reflects the dualistic principle of the inseparable connection between the material. Ogbonnaya (2022) explains duality in African philosophy as the understanding that reality consists of two complementary and inseparable entities or aspects. Sipeyiye (2023) found that in the Ndau religio-culture, digitalisation is neither new nor opposed to the Ndau ways of being, knowing, and doing, but serves as an amplification of the indigenous digital communication forms. The modern digital mediums and the Ndau medium can converge the seen and the unseen, the present and the not present, and material and immaterial forces. For example, the respondents in Sipeyiye's study characterised the Makoto (rain petition process) as a technological process and ritual communication with invisible beings, enabled by drumming, singing, and dancing.

The Makoto process and the use of technological devices resonates with Zulu's (2013) observation that the drum is not simply a musical instrument but also a telecommunication system, as well as a sacred tool that enables the connection between ancestors and Yena (a spatial being unrestricted and unspecified by gender). The drum serves as a medium for Yena to achieve a state of unbounded freedom and inspiration. According to Zulu (2013, p. 10), "Yena is affirmed through philosophical transcendence by the sacred sounds of the drum without being neither constrained

nor defined by the perturbations of the turbulent environment." Zulu's observation further resonates with Saidi (2016), as cited in Sipeyiye (2023), who observed that the drums provide a sense of belonging to the environment, the community, and the spiritual world. The empirical evidence presented in Sipeyiye's study aligns with the perspectives of scholars such as Armstrong (2005), Chawane (2016), and Monteiro-Ferreira (2009), who collectively affirm the legitimacy of the African thought system characterised by holism and collectivism.

This perspective of duality and interconnectedness aligns with the philosophy of NTU, which acknowledges the inherent essence of life, the interconnectedness of cosmic consciousness, and the spiritual unity present in each individual (Phillips, 1990). In the context of the Lovedu people, their interconnectedness with the various aspects of their being is best expressed by Krige and Krige (1943, p. 34), who observe that "[n]ature is not merely a physical fact; it is a living reality, an integral part of the culture. The environment is not something apart from man and his needs; it is the medium in which he lives and breathes." Similarly, in the context of the Aboriginal people, the interconnectedness and relational ontology of Quandamooka people include land, waterways, skies, spiritual and law systems, animals, plants, climate, and spirits collectively referred to as entities (Martin & Mirraboopa, 2003). The entities are not hierarchical; instead, they live in close relationships with one another. Consequently, people are considered equal to other entities, and the strength of the country is seen in the relationships between these entities. While African and Aboriginal philosophies are different, the literature review suggests that, ontologically, both contexts recognise the interconnectedness, relational aspects, and co-existence between human and non-human elements. This highlights the principle of co-existence, where human and non-human entities are seen as living in harmonious and interdependent relationships, contributing to a unified understanding of existence.

In conclusion, the dynamic and evolving nature of Ubu-NTU, the interplay between ontology, epistemology, and language, as well as the diverse ontological states discussed above, collectively contribute to a comprehensive understanding of African philosophy, embracing multiple realities, plurality, duality, co-existence, and relationality. These interconnected principles offer a holistic view of existence, where various aspects of being, human and non-human are seen as interdependent and in constant interaction, reflecting the fluid and interconnected nature of the African thought system.

2.5 In pursuit of epistemic freedom: Exploring Mandhwane, a culturally embedded approach to DT

The research gap identified in the review concerns the need for contextual DT grounded in local ontologies and epistemologies. Moreover, the literature review suggests that ICT4D scholars often engage in studies that seek to deal with local ontologies and epistemologies from the etic position. Miller (2005) explains the etic approach to research as a method employed by scholars who aim to study behaviour from an external standpoint, focusing on examining and comparing different cultural contexts from a positivist perspective. On the other hand, the emic approach studies behaviour from within the system, focusing on the analysis of only one culture. However, from Miller's perspective, an emic approach does not strictly imply that scholars must be from the communities they seek to observe. As such within the ICT4D research scholars from diverse cultural contexts conduct research to contribute

to indigenisation theories. However, Davison (2021, p. 767) observes that " [r]esearchers in the Global South tend to rely almost exclusively on theories developed in the Global North. Davison (2021) posits that this reliance is a form of unconscious hegemonic participation as it privileges the superiority of theories developed in the Global North at the expense of the indigenous concepts valid in the multifarious contexts of the Global South." Davison's view is supported by Sipeyiye (2023), who posits African epistemological resources are frequently disregarded and deemed unsophisticated and traditional by African scholars who choose to operate within colonial frameworks.-Ndlovu-Gatsheni (2018) explains epistemic freedom as the right to engage in one's thinking, theorising, world interpretation, methodology development, and writing, all grounded in one's specific location and free from the constraints of Eurocentrism.

Expanding on the perspective regarding epistemic freedom, it is imperative that African researchers carefully consider their methodological approaches to effectively address the distinct challenges present in Africa, as emphasised by Bob-Milliar (2022). Furthermore, the author argues that African scholars must adopt interdisciplinary research methods to guard against excessive reliance on quantification while considering African studies historical and contextual aspects in their research endeavours. For example, Mamdani (2011, as cited in Bob-Milliar, 2022, p. e56) posits that "Western knowledge production systems often treat Africa as raw materials (data) provider to external academics, who then process the information and reintroduce their theories to Africa."

Sonkqayi (2023) posits that epistemicide, or the killing of knowledge systems, happens when a particular knowledge is elevated, often overshadowing local or indigenous knowledge systems, ultimately resulting in the decline or extinction of these traditional knowledge systems. Additionally, due to the marginalisation of African knowledge systems by the global systems of knowledge production and the othering of non-Western ways of knowing, African scholars often participate in epistemic hegemony (Murove (2018). According to Murove (2018, p. 174), "instead of contributing to the Western hegemony of knowledge, African scholars need to engage in the intellectualisation and production of local IKS discourse and inclusionality, even in resource-constrained circumstances." As part of decolonisation there is also a need for Africans to have a say in conceptualising the governance of digital technologies (van Stam, 2021). This section discusses epistemic freedom and its relevance to DT in an African context, social learning, and the philosophy of Mandhwane as a learning pedagogy and a way of thinking about and transforming society.

2.5.1 Philosophy of Mandhwane

Knowledge systems that were previously marginalised are re-appropriated in policy development, agricultural activities, and environmental management (Cannarella & Piccioni, 2011, Masoga & Shokane, 2019). For instance, the Ghanaian government implemented the Sankofaism policy to reclaim elements from the past that were deemed relevant to the modern era. The Sankofaism policy framed cultural heritage as a prerequisite for the Ghanaian nation-state's development, self-definition, and legitimacy (Pijnaker & Spronk, 2017). "Sankofa symbolises the Akan people's pursuit of knowledge through critical reasoning and thorough examination of the past. The Akan people believe that the past is a guiding resource for future planning and acquiring wisdom from the past is essential for shaping a robust future" (Slater, 2019, p.2). Building on the Sankofa cultural framework, this study is grounded in

the values of Sankofa by exploring the ancient pedagogy of Mandhwane in contextual DT. Table 2.1 captures the variations of the spelling of "Mandhwane" in different communities in Southern Africa. In pursuit of epistemic freedom, this study adopts "Mandhwane" as its operational concept to align with the emic perspective of Mandhwane in the MTA. I use the other spelling variations when quoting scholarly works on the philosophy of Mandhwane.

Table 2.1: Variations of the spelling of "Mandhwane"

Mahundwane	Tshivenda
Mandhwane	Lovedu
Mandwani (Krige & Krige,1943)	
Mahumbwe	Shona
Mantlwane/ Mantlwa-ntlwane	Northern Sotho and Setswana
uMendlwane	isiXhosa

Note: This table captures the variations of Mandhwane in various communities.

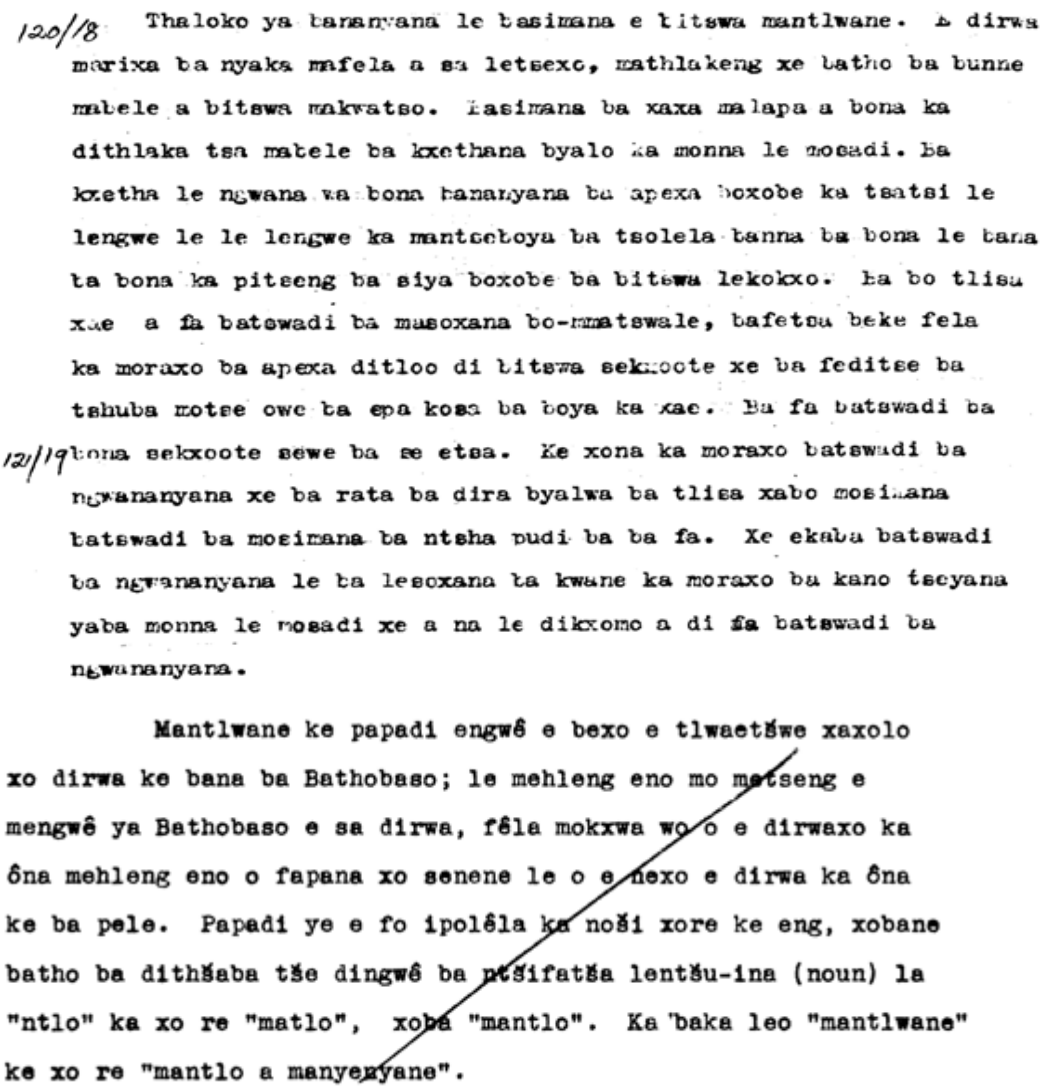
Mandhwane is an African learning pedagogy that was predominantly practised in Southern Africa as an institute of learning before the introduction of Western education. Daswa et al. (2018) posit that the philosophy of Mandhwane is not well documented and there is a loss of institutional memory relating to its origins and activities. The author relied on oral knowledge transfer to understand the philosophy of Mandhwane, by facilitating conversations with elder members of the community. This study also relied on oral history and the review of historical documents to learn about the ontological and epistemological underpinnings of Mandhwane and its application in the water sector, championed by Mma Tshepo Khumbane. The next section discusses the origins of Mandhwane and its application by African societies.

2.5.2 Historical perspectives on the philosophy of Mandhwane: Embedding knowledge and skills

The digital African Heritage collection at the University of Pretoria[8] includes Mokgohlwe's (1939) and Modiba's (1938) reflections on the evolution and practice of Mantlwane by the different communities in the former Transvaal, including the Balobedu people, as illustrated in Figure 2.10.

[8] https://repository.up.ac.za/handle/2263/76092?show=full.

Figure 2-10: Historical description of Mandhwane



120/18 Thaloko ya bananyana le basimana e bitswa mantlwane. A dirwa marixa ba nyaka mafela a sa letsexo, mathlakeng xe batho ba bunne mabele a bitswa makvatso. Basimana ba xaxa malapa a bona ka dithlaka tsa mabele ba kxethana byalo ka monna le mosadi. Ba kxetha le ngwana wa bona bananyana ba apexa boxobe ka tsatsi le lengwe le le lengwe ka mantsoboya ba tsolela banna ba bona le bana ba bona ka pitseng ba siya boxobe ba bitswa lekokxo. Ba bo tlisa xae a fa batswadi ba masoxana bo-mmatswale, bafetsa beke fela ka moraxo ba apexa ditloo di bitswa sekxoote xe ba feditse ba tshuba motse owe ba epa kosa ba boya ka xae. Ba fa batswadi ba
120/19 bona sekxoote sewe ba se etsa. Ke xona ka moraxo batswadi ba ngwananyana xe ba rata ba dira byalwa ba tlisa xabo mosimana batswadi ba mosimana ba ntsha pudi ba ba fa. Xe ekaba batswadi ba ngwananyana le ba lesoxana ba kwane ka moraxo ba kano tsoyana yaba monna le mosadi xe a na le dikxomo a di fa batswadi ba ngwananyana.

Mantlwane ke papadi engwê e bexo e tlwaetšwe xaxolo xo dirwa ke bana ba Bathobaso; le mehleng eno mo metseng e mengwê ya Bathobaso e sa dirwa, fêla mokxwa wo o e dirwaxo ka ôna mehleng eno o fapana xo senene le o e bexo e dirwa ka ôna ke ba pele. Papadi ye e fo ipolêla ka noši xore ke eng, xobane batho ba dithšaba tše dingwê ba ntšifatša lentšu-ina (noun) la "ntlo" ka xo re "matlo", xoba "mantlo". Ka baka leo "mantlwane" ke xo re "mantlo a manyenyane".

Note: This figure shows Mokgohlwe's description of Mantlwane, captured in 1938 as part of Dr Van Warmelo's collection. The digital African Heritage collection at the University of Pretoria captures the history of Mantlwane, documented by various African scholars, as part of Dr Van Warmelo's collection spanning 30 to 40 years when he was employed in the Department of Bantu Affairs as a state ethnologist for the South African apartheid government.

Despite their distinct locations and languages, the authors describe Mantlwane as a game that children played after the harvest season, supervised by their parents. Van Warmelo's description is similar to that of Krige and Krige (1943), who describe Mandhwane in the context of the Lovedu (Lobedu) as an institution to teach boys and girls about their roles and responsibilities. While Mandhwane was perceived as a game, the parents played a supportive role by overseeing Mandwani's activities and offering feedback. According to Krige and Krige (1943, p. 105), in addition to Mandhwane, the Lovedu children

> [l]earn the tasks required of adults simply by doing them. They are anxious to imitate their elders, and there is never any compulsory element in the teaching of these skills. Moreover, in their education they have the advantage, that it is not carried out in an institution divorced from everyday adult activities. The child feels that he is an

> essential part of society; all he does is a direct contribution to the domestic economy. If a small girl of five accompanies her mother to the fountain and returns solemnly carrying a diminutive calabash of water on her head, she feels she is doing important work, for her contribution will be used with that of her mother.

Moreover, for the Lovedu people, affirmations are part of the learning process. Krige and Krige (1943, p. 105) observe that "to a helpful toddler, its mother might say, thank you my lady (Ahee khoba ya ga), praising her by implying that she has already reached the maturity of usefulness of a mature woman". When it comes to the role of children in society, Krige and Krige (1943) observe that the Lovedu people affirm their children through maxims such as "hu beba hasi hu ka muroho", meaning that "children are always of value, unlike relish, which can be used once only". Krige and Krige's characterisation of Mandhwane is consistent with that of Goldin and Gordon (2010), who describe Mantlwa-ntlwane as a means of education centred around practical production and skills development. The design of Mantlwani actively involves parents in their children's learning process, with parents refining and guiding their children to enhance their skills. Ramugondo (2012) posits that much of Mahundwane mirrored everyday life, including a simulated political system with chiefs and elders presiding over judgments. Children emulated adult roles, engaging in practices that they witnessed their elders perform – seeking food, preparing and preserving it, resolving disputes, and even worshipping (Mutema, 2013).

2.5.3 Application of Mandhwane in modern day society

In modern times, Tatira et al (2012, p.81), through Mantlwane, children learn "a multitude of mathematical skills are developed, for example, volume, measuring length and fostering identification of solid shapes during their modellings." The observation by Tatira et al. (2012) aligns with that of Adeyemi and Adeyinka (2003), who postulate that customary African education is rooted in philosophical foundations, encompassing communal learning, role modelling, practical skills imitation, cultural heritage preservation, and embracing multiple competencies. Thus, the principles of Mandhwane as deduced from the literature review encompass learning through practical experiences (learning by doing), embracing trial and error, striving for ongoing improvement, acknowledging the value of failure in learning, gaining insights from parents and peers, fostering resource-efficient innovation, using storytelling as an educational tool, encouraging collaborative creation, and promoting holistic systems thinking.

Daswa et al. (2018) applied socio-cultural theory in their research to explore ways in which children could learn responsible family life and responsible citizenship in general by drawing lessons from the philosophy of Mahundwane. Due to the limited documentation, the first step in their study was to understand the origins of Mahundwane, by interviewing elderly community members in Venda to fill their knowledge gap. Daswa et al. (2018) note that during their data collection, they learned a deeper philosophical meaning of the word Mahundwane, which relates to society and culture. Daswa et al. (2018) learned that Mahundwane is an important rite of passage in Vhavenda culture because it teaches and establishes in children the duties and roles that they must perform when they grow up and have families.

However, the practice of Mandhwane lost its essence and originality because some parents did not approve of it due to the unintended consequences of pregnancy and because of the migrant labour system, which removed boys of age

from the villages to seek employment in the cities, and because Christian missionaries regarded Mandhwane as a practice for heathens. The more people converted to Christianity, the more the practice became irrelevant (Ramugondo, 2012). This study views Mandhwane positively as a philosophy and practice that facilitates learning, innovation, knowledge, and skills transfer. The above discussion reveals that African communities made an effort to integrate Mandhwane as a way of knowledge and skills transfer, supported by communal structures.

2.6 Botho, Mandhwane and mind mobilisation: Lessons from Tshepo Khumbane

The previous discussion indicates that Mandhwane is a philosophy applicable to various domains of society. This study draws lessons from Mma Tshepo Khumbane who used the philosophy of Mandhwane to design mind mobilisation, a social learning and reflective process deeply rooted in Botho values (de Lange et al., 2009; Goldin & Gordon, 2010; Hart & Baiphethi, 2008; Khumbane, 2018). In the context of this study, Mandhwane and mind mobilisation provide the foundation for the proposed paradigm shift from deterministic ICT4D to contextual and culturally embedded DT. Khumbane's approach offers a culturally embedded perspective on community participation in an African context, encompassing problem-solving, innovation, and the collective mobilisation of mental capabilities. Khumbane incorporated social work methodologies of group dynamics, which involve community and household interactions, intergenerational collaboration, and leveraging household and natural resources as integral components of the innovation process.

She described Mantlwa-ntlwane as a transformation tool that, if used strategically, it can assist Africans to stop depending on ideologies and strategies imported from the West and, more recently, from China. She argued that foreign strategies do not align to local conditions and lifestyles. As a result, the strategies make Africans feel incapable. She believed that Africans need to interpret their culture positively and that Mantlwa-ntlwane is a strategy to move Africans forward creatively. She shared that she did not play Mantlwa-ntlwane because of her Christian affiliation. However, she observed other children playing Mantlwa-ntlwane in Tshukudung village in Limpopo Province:

> When I saw Mantlwa-ntlwane, I did not participate. It was beyond my social environment at the time because, being Christian, we were not allowed to play; we regarded all those ceremonies as heathen activities. The colonisation by the missionaries prevented us from participating. We could not comprehend why they told us not to go to Mantlwa-ntlwane village because, from our observations, we could see those people were having a good time. They were playing in the children's village. They created a children's village, and every child had a responsibility. They received coaching from their elders and organised a function for children to cook for their parents. Mantlwa-ntlwane was a system to train children into adulthood instead of talking or being theoretical. They were doing it practically to unleash their creativity and take responsibility. Nevertheless, I learned through observation and what I saw as I analysed deeper. I found a philosophy that cuts across the development of humankind. I observed that they are looking at the stages of a child's development into maturity. It was about work, responsibility, resilience, and understanding to chart your road to self-discovery. It is what I do; it matches very clearly with the programme I have developed under mind mobilisation. Mantlwane is precisely what the Chinese people are doing, but now we are flying to China to learn Mandarin.

According to Khumbane, Mantlwa-ntlwane incorporates the principles of dealing with conflict over limited resources, respect for the environment, the value of self-reliance, and Botho. Khumbane applied the philosophy of Mandhwane and mind mobilisation intervention in water resources management and food security for communities in resource-constrained environments in South Africa and Lesotho. The mind mobilisation approach is recognised as an innovative method that empowers individuals to confront their circumstances (de Lange et al., 2009; Goldin & Gordon, 2010; Hart & Baiphethi, 2008; Khumbane, 2018; Magoro & Bidwell, 2022). The review of Mma Tshepo Khumbane's historical documents and my personal conversations with her reveal that mind mobilisation was grounded in self-reflection and futuristic strategies that enabled participants to re-imagine their future, free of poverty and hunger, and living in abundance and in harmony with the environment.

> It was through the mind mobilisation process that I handed power to the people; they embarked on their journey to self-discovery, creating safety nets, moving from food insecure to food secure households and communities. I conducted mind-mobilisation sessions that aimed to take the marginalised outside of the poverty pit. I held their hands to come face to face with poverty at the individual, household, and community levels. Through the process of self-reflection, I have witnessed transformation. Self-reflection empowers the marginalised to depict their real situation; it speaks to their social, political, economic, and psychological dynamic. Mind mobilisation is a strategy that I used to liberate the mind. I used it to shut down silent voices that confronted the powerless. (Mma Tshepo Khumbane, 2018)

This liberated mindset, as envisaged by Khumbane, plays a crucial role in informing and enhancing the voluntary collaboration and communal ethos advocated by Letšema economics and Letšema social learning. It contributes to transformative change for communities in resource-constrained environments by fostering collective empowerment and resilience. This mindset transformation directly supports a broader vision of social cohesion, underpinned by a shared commitment to overcoming common challenges.

Building upon this foundation, Khumbane applied mind mobilisation as an alternative approach to the conventional community participatory approaches (PRA). The core components of the process include village scoping as captured in the process follow. The purpose of village scoping is to understand the dynamics (social, economic, political) of the villages. Based on the outcomes of the scoping, individuals are nominated to participate in the mind mobilisation programme. However, before embarking on the programme, Khumbane organised a follow-up session to conduct a candlelight ceremony conceptualised as a sacred ritual facilitated at a community level. The ritual aimed to burn the inferiority complex, negative vibes, and feelings of despondency. It served as a binding ceremony that forced the community to hold hands and understand that they could defeat hunger and malnutrition through the power of collectivism and the creation of community safety nets, supported by community institutions such as the tribal authority, households and community at large in creating an enabling environment.

According to Khumbane, the candlelight ceremony was crucial in healing the mind because social change, whether involving technology or not, requires policymakers and practitioners to dedicate 30 per cent of their time to addressing technical issues and 70 per cent to dealing with the mind. Khumbane believed that any development initiative that fails to focus on the psychological barriers caused by historical legacies will not produce the desired change at the individual, household, and community levels. She emphasised healing internal wounds, empowering

minds, and ensuring food security as the first step to transformation (Hart & Baiphethi, 2008). She advocated the transformation of both individuals and the community at large through group work methods, fostering collective problem-solving, as she believed that addressing issues on a case-by-case basis is not the most effective approach, as the focus on changing the individual might lead to recurring problems. Manwaring (2007, p. 132) highlights that Khumbane conducted mind mobilisation in a workshop format, using visualisation and self-reflective processes packaged as the helicopter plan illustrated in Figure 2.11. The helicopter plan serves as a futuristic plan to help participants to reimagine their futures.

Figure 2-11: Mma Tshepo Khumbane's helicopter plan (aspirations based on land ownership)



Note: This figure illustrates Mma Tshepo's helicopter plan, which she used to encourage the mind mobilisation participants to create a five-year plan that would serve as a roadmap for turning their situation around. This was followed by Khumbane's personal story, and she shared her experiences and lessons from projects that she has implemented over the past 40 years in places such as Lesotho, Tzaneen, Sekhukhune, Bochum, and the Free State.

Participants were not instructed on what to draw, and Khumbane refrained from revealing her plan, allowing individuals to represent their authentic situations. This approach acknowledged the diverse social, psychological, political, family, and economic dynamics inherent in each person's circumstances. The visualisation processes served as a way for participants to articulate and address these multifaceted dynamics, which may involve social dynamics in households or the expression of profound trauma, leading some individuals to have emotional responses.

2.6.1 Letšema collective human capabilities

Khumbane promoted the establishment of social clubs as platforms to transform individuals and mobilise them into a communal entity with shared norms and values, aligning with African traditional systems of community

management, based on the principles of Botho and Letšema. Letšema embodies the essence of Botho, representing a form of voluntary collaboration among community members to achieve well-being (Hart & Baiphethi, 2008). Letšema aligns with the "people as infrastructure" (Simone, 2021). "People as infrastructure" entails a mathematical process of the perpetual recombination of people's experiences and practices, and individuals not just as passive participants but as technical agents whose actions contribute to the dynamic generation of collective possibilities beyond explicit intentions (Simone, 2021). The resilience and resourcefulness of Letšema participants in addressing psychosocial support needs, despite the absence of formal services in Southern Africa, aligns with the resilience and agency of "people as infrastructure" (Ebersöhn et al., 2018). Similarly, the Balobedu people relied on Letšema for agriculture and construction services (Krige & Krige, 1943).

Before colonisation and the effects of migration, the Lovedu people could tap into their collective power to support agricultural activities. Their mindset enabled them to tap into the collective capabilities because their culture did not view life as a "competitive struggle, even in respect of the things that are limited in supply" (Krige & Krige, 1943, p. 52). Rather than focusing on achievement and material wealth, the Lovedu people prioritise maturity and self-sufficiency. However, they view moderate success as being attributable to industry, while excessive success may raise suspicion. Therefore, those who acquire significantly more than their neighbours might be regarded as being aligned with anti-social forces and may be viewed as enemies in the community. Consequently, those who accumulate more than others fear exclusion. According to Krige and Krige (1943, p.52), "the Lovedu worldview values a sense of balance and disapproves of extreme wealth accumulation or achievements that are perceived to go beyond the community's norms. While Krige and Krige (1943) did not analyse the interaction between the Lovedu culture and technology, their observations provide insights into the ontological underpinnings of Letšema collective work.

2.6.2 Social learning and skills transfer

Building on the collective and participatory nature of Letšema and the insights from African community management principles, the following section delves into social learning theory. Social learning theory is associated with Bandura, who suggested that individuals learn by observing, modelling, or imitating others and their social interaction in a group (Bahn, 2001). Despite the popularity and application of social learning in development settings and education teaching pedagogies, scholars criticise social learning for its lack of theoretical foundation (Reed et al., 2010). Reed et al. (2010) describe social learning as a transformation in one's comprehension that extends beyond the individual and becomes embedded in broader social units or communities of practice (CoPs), facilitated by interactions among actors in social networks. In a community of practice, people come together to fulfil a shared set of needs (Hefetz & Ben-Zvi, 2020). In addition to the above weaknesses, Bandura's definition of social learning is limited as it focuses on the individual learner instead of the collective (Pahl-Wostl et al., 2007).

Furthermore, Lindley (2015) cautions against treating social learning as an end, emphasising that it should not be objectified or used solely to achieve specific outcomes. Instead, it should be regarded as a learning process with a socially critical orientation and is characterised by outcomes that are not pre-established or predetermined. According to Lindley (2015, p.53) "the crux of social learning is not what people need to know, which could be seen in the light of the scientific instrumentalist orientation, but rather how people learn and what they want to learn, and how

they will be able to challenge and transcend societal norms for a more sustainable future."

For instance, Tran and Rodelad (2019) observed that in Vietnam, the interaction of households in the farming communities represents collective learning through social interaction, communication, and individual learning through self-reflection. Their study indicates that social learning has the potential to stimulate locally driven innovations that are culturally rooted and based on kinship or bonding. Moreover, social learning is a dynamic process encompassing various levels of learning loops, from single-loop to triple-loop learning (Tran & Rodelad, 2019). Khumbane's mind mobilisation mirrors the social learning approach by utilising self-reflection tools, guiding participants through experiential learning, and enabling them to practically apply their new found knowledge and skills.

In social learning, there are other related theories, such as situated learning, creative pedagogy, and contextual learning (Aleinikov, 2013; Carvalho & Yeoman, 2018). Carvalho and Yeoman (2018) highlight that learning is influenced by its context, encompassing its epistemic, physical, and social aspects, underscoring the significance of the learning environment. For instance, in the mind mobilisation process, participants document their day-to-day water and food security management. Matšema-facilitated collaborative learning platforms where groups of households interacted on an ongoing basis. Through regular interaction and collective learning, individuals deepen their knowledge and expertise (de Paiva Duarte, 2013).

2.6.3 Appropriate infrastructure

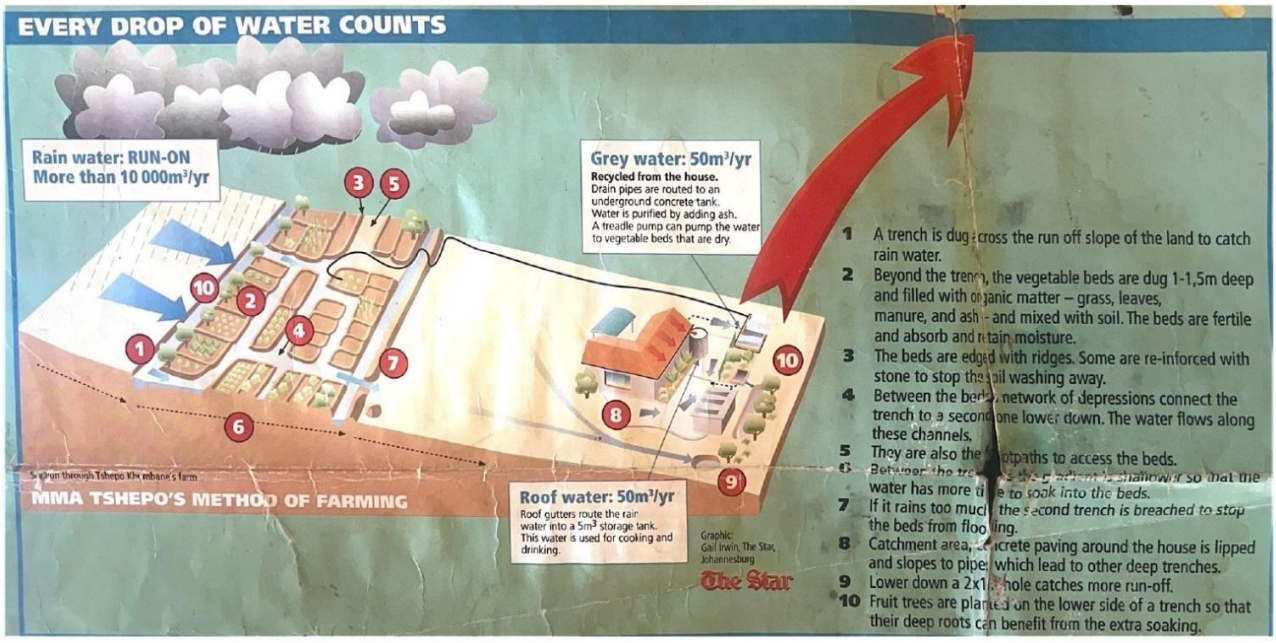
Khumbane's approach to infrastructure design, particularly in the areas of water harvesting and weather monitoring, extends beyond the reliance on digital tools. She effectively employed non-digital data analytics, such as manual weather charts and traditional data collection methods, to monitor and manage environmental factors illustrated in Figures 2.12 and 2.13, refer to Appendix B for more details on Khumbane's integrated solution. These systems allowed for the capture of critical data, which she used as a foundation for her integrated water resource management strategy, ensuring food security and sustainable agricultural practices. Her use of non-digital data analytics represents a forward-thinking approach, emphasising the importance of preserving traditional knowledge systems while also recognising the innovation potential. Khumbane's work embodies a futuristic approach to food security and environmental conservation.

Figure 2-12: A weather chart and a time management schedule that captures household tasks



Note: This figure illustrates Khumbane's daily weather monitoring chart. The chart captures weather patterns and integrated cultural knowledge systems that Mma Tshepo uses as part of her integrated water resource management and food security strategy.

Figure 2-13: Khumbane's integrated and appropriate technology for water resources management



Note: This figure illustrates Khumbane integrated solution extracted from International Water Management Institute (IMWI) and Water for Food Movement showcasing Khumbane's holistic approach to water resources, sanitation, and food security management systems .

2.6.4 Communal leadership

Khumbane fostered collective leadership and collaboration through the establishment of CoPs, while also facilitating follow-up sessions, mentorship, and coaching, thereby ensuring that the skills and knowledge gained were sustained and shared within the community. Furthermore, the tribal authority played an active role in mobilising the community to participate in the programme. While children actively participated in the documentation of daily tasks, water charts and designing the water rain gauges for their parents.

2.7 Chapter summary

The review highlights a notable shift from deterministic approaches towards holistic approaches and indigenous theories like Ubu-NTU. However, systems thinking rooted in local ontologies and epistemologies remains a missing link in exploring ICT4D contextualisation within rural African communities. The inclusion of contextual and culturally embedded knowledge systems as cross-cutting dimensions provides an integrated approach to exploring the research problem. In summary, the discussion highlights the interconnectedness between mind mobilisation, Letšema economics, and Letšema social learning and Mandhwane philosophy as applied by Khumbane. Collectively, these concepts provide practical insights into how systems thinking and holistic culturally embedded approaches rooted in ontology and epistemology could be applied to facilitate non-deterministic and people centred transformation, digital or non-digital. In the next chapter, I discuss the research design and methodology.

CHAPTER 3 ：RESEARCH DESIGN AND METHODOLOGY: SOCIAL CONSTRUCTIVIST CASE STUDY

3.1 Introduction

In the previous chapter, I provided a critical analysis of ICT4D theory and practice and suggested a shift towards an Afrocentric paradigm, incorporating holistic systems thinking and culturally embedded DT. Building upon this critique and the pursuit of epistemic freedom, in this chapter, I discuss the philosophical and theoretical foundation for the research and the research design.

3.2 Research methodology

Cecez-Kecmanovic (2011) explains research methodology as the comprehensive strategy governing the conceptualisation, execution, and validation of knowledge claims. Research methodology encompasses the development of research questions to inform the research design and ensure coherence between research objectives, data collection, and analysis (Bryman, 2007). In line with this understanding, I developed five interdisciplinary sub-questions to address various components of the theoretical analytical framework adapted for this study. The first three sub-questions focus on perspectives regarding cultural frameworks and community agency concerning collective capabilities, the advancement of socio-economic aspirations, and digital skills. These are followed by perspectives on digital infrastructure and the role of leadership in DT. Each sub-question contributes to this investigation by examining different aspects of the research problem. Collectively, these questions aim to conduct an in-depth interdisciplinary and multilevel exploration of the main research question: How do cultural knowledge systems facilitate the active and inclusive participation of African rural communities in DT?

> **Sub-question 1**:How do deeply embedded cultural practices unlock collective human capabilities for rural DT?
>
> **Sub-question 2**: How can a culturally embedded approach facilitate inclusive digital adoption and use to advance rural socio-economic aspirations?
>
> **Sub-question 3**:To what extent do culturally embedded knowledge systems facilitate the digital skills development required for active participation in the DKE?
>
> **Sub-question 4: What** is the appropriate digital infrastructure to facilitate the development of localised solutions for inclusive DT?
>
> **Sub-question 5: How** can digital leadership facilitate a people-centred and digitally connected transformation?

I begin this chapter with a critique of ICT4D research to contextualise the theoretical and philosophical foundations that underpin the study and the research design. This critique establishes the foundation for the constructivist and Afrocentric lenses applied in this interdisciplinary study.

3.2.1 ICT4D research and contextual interdisciplinary methodologies

According to Ramadani et al.(2018,p.2429 - 2430), there are three primary research streams in ICT4D, namely, technology-transfer, social-embedded, and transformative. The technology-transfer stream focuses on technology diffusion and employs quantitative methods, whereas the social-embedded stream focuses on socio-technical dynamics and employs qualitative approaches to study the phenomenon of ICT4D. The transformative stream employs qualitative methods and frameworks such as the capability approach. Ramadani et al.(2018) highlight that while each stream provides valuable insights, they also encounter challenges, underscoring the necessity of a holistic approach that integrates perspectives from all three streams. Additionally, scholars use technology adoption models (TAMs) and the unified theory of acceptance and use of digital technologies (UTAUT) to understand contextual factors that contribute to the adoption and use of technology (Frans & Pather, 2021; Mannan et al., 2017; Miranda et al., 2016).

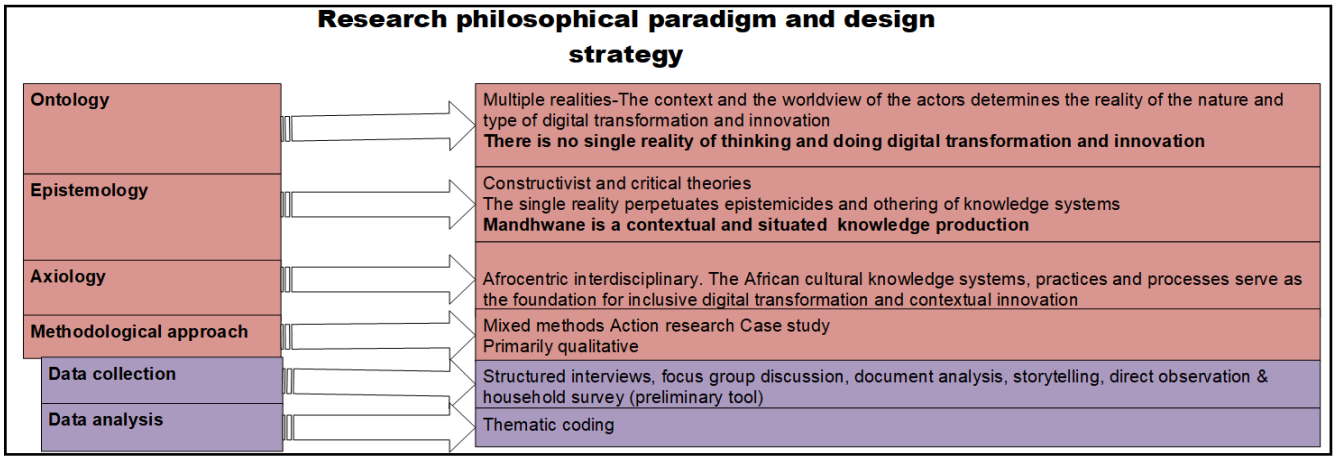
Ramadani (2017) noted that ICT4D research published in IS journals traditionally emphasises organisational aspects, creating a gap in multidisciplinary analysis and potentially marginalising community voices, thereby limiting understanding of ICT implementation across macro-, meso-, and micro-levels. In cases where scholars apply social embeddedness approaches, an insufficient understanding of the local context persists due to a lack of in-depth qualitative case studies, participatory methods, action-research, and experimental research designs (Lwoga & Sanged, 2019). Kim and Lee (2023) posit that while research in the field of ICT4D has advanced from behaviourist viewpoints to encompass broader macro-level issues, it predominantly concentrates on national-level aspects, with insufficient attention being paid to global dimensions such as privatisation, the global development-and-technology complex, and the political-economic forces influencing the field (Kim & Lee, 2023). On the other hand, Uys and Pather (2020) postulate that the unique context of ICT4D initiatives implemented in communities necessitates a different research approach. Diverse methodological approaches beyond the confines of the positivist paradigm need to be adopted to gain a comprehensive understanding of Africa's social realities (Moyo & Mutsvairo, 2018, as cited by Mutsvairo et al., 2021).

3.2.2 Research philosophical paradigm and design: Interdisciplinary social constructivist and emic Afrocentric researcher

In this section, I discuss my research philosophical paradigm as shown in Figure 3.1. Research philosophy involves the researcher's ontology, epistemology, and axiology, the choice of research strategy, the formulation of the problem, data collection, processing, and analysis (Kivunja & Kuyini, 2017; Žukauskas et al., 2018). Research paradigms shape the researcher's view of the world and how they approach their research, dictating what the researcher sees or does not see, and it influences the type of questions that they ask and how they analyse data (Heeks & Wall, 2018). In addition to the philosophical paradigm, the theory makes it easier to read someone's research because it enables the researcher to state upfront their ontology, epistemology, and axiology, as well as the lens they will be using throughout the research project (Neuman, 2011). In this study, I employ a holistic and multilevel approach that advances interdisciplinary theoretical frameworks, methodological approaches grounded in social

constructivism, emic Afrocentric paradigm and critical emancipatory theory (Heeks & Wall, 2018; Howell, 2013; Myers & Klein, 2011). The Afrocentric paradigm underpins the methodological approach for this study, centring on the legitimacy of the African thought system of holism and collectivism, a place that acknowledges as legitimate the mythology, cosmology, belief systems, African cultural reality, and values of African people (Armstrong, 2005; Chawane, 2016; Monteiro- Ferreira, 2009).

Figure 3-1: The research philosophical paradigm and design strategy



Note: This figure illustrates my philosophical paradigm and design strategy, highlighting ontology, epistemology, axiology, and the methodological approach employed in this study.

3.2.3 Researcher's ontological stance

Ontology refers to the nature of our beliefs about reality (Rehman & Alharthi, 2016). I hold the belief that reality is not singular; instead, it encompasses multiple perspectives, influencing and shaping various approaches to DT. The dominant Western and Silicon Valley ontologies, as discussed by Mutsvairo et al. (2021), represent one approach to DT. However, they fall short of accurately capturing the diverse realities of communities in resource-constrained environments in Africa.

My ontological lens is grounded on Afrocentric paradigm rooted in the pluralistic nature of African thought system of holism and collectivism, which recognises the mythology, cosmology, belief systems, cultural reality, and values of African people as legitimate (Armstrong, 2005; Chawane, 2016; Monteiro-Ferreira, 2009). The Afrocentric paradigm is one of the methodologies that scholars use to explore ontology, epistemology, and axiology in different disciplines. Bent-Goodley et al. (2017, p.1) postulate that "Afrocentricity is a concept that existed long before it was named and identified by scholars." The literature suggests that scholars across different fields, such as education and social work, employ the Afrocentric paradigm. In the context of social work, for instance, the Afrocentric paradigm seeks to validate and systematise the principles and cultural traditions of traditional Africa into a framework for fostering positive human transformation and potential (Schiele, 2017).

The Afrocentric paradigm is about the legitimacy of the African thought system of holism and collectivism. This

place acknowledges as legitimate the mythology, cosmology, belief systems, African cultural reality, and values of African people, without seeking validation from the Eurocentric paradigm (Armstrong, 2005; Chawane, 2016; Monteiro-Ferreira, 2009). In this regard, scholars aiming to develop contextual theories within the Afrocentric paradigm face challenges, as highlighted by Mazama (cited in Sipeyiye, 2023, p.4), who posits that "there is still confusion on the definition of the term Afro-centricity as some scholars tend to give own definitions, free versions and often choosing to emphasise on certain aspects of the paradigm to suit their own purposes".

According to Sipeyiye (2023, p.4), "the purposes invariably include a drive to mount a counterattack on former colonial powers and their vaunted Eurocentric epistemologies. The effort tends to degenerate into a practice of racism in reverse which is one major challenge of the theory." This ambiguity surrounding the definition of Afrocentricity has significant implications for its application across various disciplines, particularly when scholars seek to operationalise the paradigm within their specific fields. In this context, Mkabela (2005) posits that African scholars using the Afrocentric research method should focus on African cultural reality. Afrocentric researchers must recognise the importance of including African values and experiences to accurately explain the research question. My ontological lens challenges the dominant, singular Western ontologies that often overlook the diverse and complex experiences of African communities, particularly in resource-constrained environments. Therefore, I grounded my inquiry in the experiences and perspectives of the Balobedu ba Mamaila Kolobetona by embracing the pluralistic view of what constitutes reality in the community. For example, I did not impose my belief systems relating to funeral practices and financial management embedded in the Leola practice (the communal funeral scheme). Instead, through my ability to engage with the contextual perspectives and communal cultural framework, I was empowered to learn more about my culture and the philosophical underpinnings of practices such as Leola and its intersection with the living and the departed.

3.2.4 Researcher's epistemic stance

Epistemology is about "the creation, nature, and forms of knowledge, how it is acquired and transferred to other human beings" (Kivunja & Kuyini, 2017; Rehman & Alharthi, 2016). Constructivist researchers understand reality as locally constructed, shaped by different perspectives and multiple realities as the researcher and the research participants continually interact and influence one another as co-creators and producers of knowledge. (Howell, 2013). I believe that African ways of knowing and doing are legitimate ways of creating knowledge, conceptualising, researching, and practising contextual DT and innovation. The research design and methodological approach highlight that, within an Afrocentric paradigm, the elders have a moral and social responsibility to transfer knowledge to the younger generation. The proverb "Rutang bana ditaola, le se ye le tšona badimong" (the intentional transfer of wisdom, knowledge, and skills to the younger generation), embodies the epistemic approach to knowledge creation in the African context, emphasising the intentional transfer of knowledge and wisdom to the younger generation. I operationalised the proverb by inviting Prof Nagy Hanna as my elder in the DT ecosystem to guide the construction of reality in Mamaila. I did this by adapting his holistic framework discussed in section 2.3. Similarly, I invited an interdisciplinary team of scholars to assist in laying the foundation for the construction of reality by reviewing the

scholarly works presented in chapter two and through interviews presented in chapter seven. I also invited African philosophers like Prof Ramose, Prof Moeketsi Letseka, and Mocholoko[9] (Dr) Zulumathabo Zulu to share their erudite perspectives on African philosophy through an in-depth analysis of the literature. Furthermore, I invoked the spirit of Mma Tshepo Khumbane to be part of the discourse through the lessons learnt from her application of the philosophy of Mandhwane and mind mobilisation methodologies in the water and sanitation sector, discussed in section 2.9.

In an African context, knowledge is socially constructed as a communal responsibility and an iterative process of meaning-making and collective understanding (Quampah et al., 2016). For this reason, in exploring the research problem, I invited my elders and youth from the MTA to co-create and construct the reality of DT with me, based on their lived experiences, presented in chapters four to six. I interacted with the research participants as experts in their knowledge systems, practices, and processes, while I assumed the position of a learner. Drawing from their daily experiences, the research participants offered valuable insights into designing the prototypes digital solutions for exploring the research questions. Continuous feedback was integral to refining the prototypes and gaining deeper insights into the constraints and opportunities inherent in the local DT ecosystem. This collective approach aligns with the participatory framework I employed in this research, where the process of co-creation and construction of reality was central to the investigation, reflecting intergenerational knowledge creation and transfer as expressed through the proverb rutang bana ditaola.

Lastly, I believe people can learn most effectively through hands-on experience, especially when the learning process aligns with their aspirations and personal goals. This belief aligns with embodied epistemology, where knowledge is not just something we think about but something we live and experience. For me, this journey of knowledge creation began before I officially entered the field of DT research or practice. I had no formal exposure to DT programs or institutions then, yet I embarked on a self-guided learning path in digital technologies. Using resources like W3Schools, I taught myself web development. In 2006, I relocated from Limpopo to Pretoria to take on the role of website manager, which eventually led to my current position as a senior manager responsible for Learning and Innovation in the public sector. My journey exemplifies the crucial role of experiential learning in knowledge creation. It shows how, through hands-on practice and continuous feedback, we refine our understanding, expand our capabilities, and transform our lives.

In conclusion, the process of co-creating and constructing knowledge in this research highlights the importance of collaboration and shared learning in digital technology development, especially within an African context. Through the active involvement of elders and youth from the MTA, I have witnessed firsthand the power of intergenerational knowledge transfer and participatory engagement in addressing the local context of DT. This approach not only empowered participants but also reinforced the value of experiential learning, both for myself and the community, in

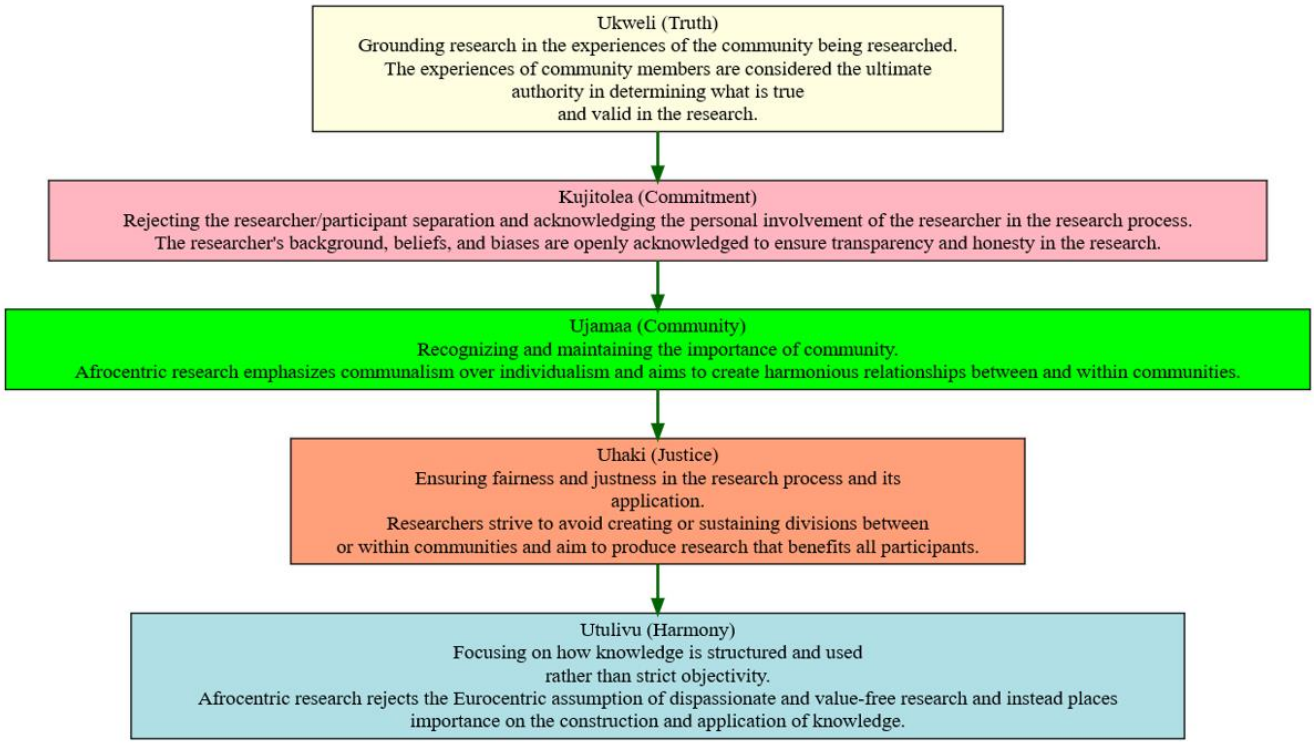
[9] The word “Mocholoko” means a doctoral student of medicine and a doctoral practitioner of cosmology. See https://zulumathabo.com/2017/10/17/african-cosmic-knowledge-and-bacholoko/.

the continuous process of refining and understanding digital solutions. Ultimately, this journey exemplifies how collective, hands-on experiences rooted in local non-digital innovations and wisdom catalyse unlocking collective digital capabilities.

3.2.5 Axiology in interdisciplinary

Axiology is about the values and value judgments of the researcher and what the research paradigm does and does not value in research (Heeks & Walls, 2018; Rowe, 2018). My value judgments in this study were grounded in values of fairness and justice and broadly relied on Afrocentric canons illustrated in Figure 3.2 as my moral compass. The Afrocentric canons, emphasise the significance of community involvement, truth grounded in lived experiences, commitment and transparency in the research process, fairness and justice, and the recognition of the importance of harmonious relationships in research. Furthermore, I employed an Afrocentric approach without defending or justifying how some cultural practices are often misused to suppress women and children by maintaining patriarchy and other systems of oppression (Manyonganise, 2015). Therefore, the focus was on what the community values, particularly collectivism and self-determination, as I believe that African rural communities possess the agency to organise themselves and drive socio-economic changes when the environment is conducive. In this study, I relied on existing capabilities and non-digital innovations within the community to explore the research problem.

Figure 3-2: The five canons of Afrocentric research outlined by Reviere (2001)



Note: The five canons of Afrocentric research serve as a foundational framework for guiding researchers towards adopting a perspective that centres on African agency, culture, and experiences while questioning and challenging prevailing Eurocentric paradigms. Source: Author, 2024.

3.2.6 Critical and emancipatory approach

In light of these community-centered values and the emphasis on collective agency, I also draw on critical IS research to inform my approach. Cecez-Kecmanovic (2011) posits that critical information system research involves examining and critiquing technological advancements and utilising information systems in organisations and society. According to the author, these systems often perpetuate control, domination, and oppression despite claims of enhancing efficiency and progress, leading to adverse social outcomes. The critical agenda within IS places greater emphasis on the researcher's involvement throughout the research process, recognising their active role in perpetuating biases during knowledge production (Cecez-Kecmanovic, 2011).

I adopted a participatory, emancipatory, and transformative approach to co-create the artefacts of the action research and co-produce knowledge with the members of the community (Chen et al., 2011; Doolin & McLeod, 2005; Matomeson et al., 2006; Myers & Klein, 2011). Critical research in ICT4D focuses on social issues such as freedom, power, social control, and values concerning the development, use, and impact of information technology (Myers & Klein, 2011). For instance, Myers and Klein (2011) applied postcolonial theory to explore the interrelationship between the macro and micro sociopolitical contexts. Their study found that an ICT4D project, implemented to improve the social and economic welfare of the Aboriginal people in a remote Taiwanese village, initially appeared tremendously successful. However, through ethnographic fieldwork, they uncovered that the Aboriginal people felt marginalised and lacked a significant voice.

Rowe (2018) explains being critical in DT research as " a self-directed and self-correcting capacity to think otherwise about an issue to see the limitations of one's or others' past or present theoretical or practical reasoning about this issue. In essence, it is about reflexivity." Self-reflectiveness and emancipation empower the actors to operate in an environment that makes cultural value systems a point of departure (Krauss, 2018). Expanding on this perspective, Rowe (2018) argues that critical research serves as a quest against injustice and unwarranted limitations of freedom. The emancipatory, self-reflective, and transformative nature of this study is rooted in Khumbane's philosophy of Mandhwane and mind mobilisation (de Lange et al., 2009).

While the participatory research approach allows researchers to engage in a co-creation process with research participants, Marovah and Mutanga (2023) caution against the unintentional perpetuation of practices that might conflict with the principles of the community. To mitigate this risk, the authors propose the incorporation of Ubuntu/ Botho philosophy principles into participatory research to promote a more inclusive and respectful research process. I relied on the principles of Letšema, Botho, Mandhwane, and mind mobilisation to engage in a reflexive process of multiple loops learning through co-creation, group learning, and detecting and correcting errors.

3.2.7 Research's reflexivity

Reflexivity, as discussed by Olmos-Vega et al. (2023), requires ongoing critical self-examination to identify and address biases, helping to mitigate subjectivity. I used reflexivity to recognise and address my potential biases and leverage my identity. I was born and raised in MTA. Although I left Mamaila village in 1996 for tertiary education

in Johannesburg and moved to Tzaneen in 1999, I have remained deeply connected to the village both culturally and spiritually. Thus, my insider status, which is deeply connected to the study context, contributed to building trust and rapport with participants. For instance, the elders referred to me as "motlogolo wa Mmakhutšo, morwêdi wa Modjadji Magoro,"recognising my ancestral connections and reminding me of my deep spiritual bond with the village. This connection reminded me that I was not alone in the research process. I carried the spirit of my ancestors with me, and my umbilical cord, buried in the village, anchored me. Consequently, this deep cultural connection to Mamaila shaped my actions. It reinforced my understanding that both the positive and negative outcomes of my research would have implications not only for me and the participants but also for my ancestors, family, and future generations.

Building on this awareness, I was guided by Afrocentric canons discussed in section 3.2.5, ensuring that the research process was respectful and reciprocal. This ethical framework shaped my engagement with participants, grounding my research in a deep respect for the community's aspirations and their agency. I made a conscious effort to ensure that the voices of the participants were captured and represented independently of my influence. Additionally, my fluency in the local language allowed for nuanced communication and a deeper understanding of the participants' views, which might have been lost or misunderstood by an outsider. My positionality implies that non-African scholars unfamiliar with the cultural nuances and language of Mamaila would have faced significant barriers in conducting this research. However, while such scholars might face challenges, they are often more privileged in terms of access to the community and able to research if supported by local researchers with translation and interpretation. Non-African scholars are often perceived as more credible or authoritative, a perception shaped by the ongoing influence of colonial legacies on how knowledge and authority are received. In contrast, African scholars, particularly those from the community being studied, may be seen as less authoritative or credible despite their deep understanding of local contexts, cultures, and languages. Therefore, while my identity shaped my engagement with the community, it did not automatically serve as a guarantee of trust or authority. My role as a researcher, coupled with my position within the community, required ongoing efforts to build trust and respect through reciprocal relationships and active listening.

Acknowledging my positionality and the influence of my identity, I also recognise that my entry into the village was shaped by biases stemming from my own childhood experiences, where I had limited interaction with the outside world and little access to information. Coupled with my education and professional background in learning and innovation, I initially assumed that rural youth, like those in Mamaila, lacked access to information and were not always aware of the transformative potential of digital technologies. However, my interactions with the Mamaila community forced me to confront and "unlearn" these assumptions. I learned that the youth were already engaging with digital resources and demonstrated an innovative, resourceful mindset. This experience revealed how academic and professional assumptions about rural areas often overlook the local capabilities and resourcefulness of communities in resource-constrained environments..

Moreover, during the research process, I played a key role in the establishment of the MCN and the Mamaila Solar Community Hub (Tech Hub). While my involvement in the projects allowed me to gain practical insights into

community development and technology, I took careful steps to ensure that these projects did not influence my research. Importantly, data collection for this study began in 2020, well before the deployment and launch of the projects in 2022. The research focused solely on understanding the cultural knowledge systems of the Mamaila community and their intersection with technology, with infrastructure being just one aspect of the broader analytical framework. As such, the research questions were independent of the two projects, and I did not analyse any data derived from them. However, my facilitation role in the projects provided me with an advantage that other scholars might not have in gaining practical insights into bridging the digital divide in resource-constrained environments and gaining perspectives on how the theoretical framework from the study can be applied in real-world contexts. In conclusion, reflexivity allowed me to critically engage with my own biases and positionality, ensuring that my research was both respectful of the Mamaila community and grounded in a deep understanding of the communal cultural framework.

3.3 Research design: Mixed-methods case study

The fundamental goal of case study research is to conduct an in-depth analysis of an issue within its context, aiming to understand it from the participants' perspective (Harrison et al., 2017). Exploratory case studies are appropriate for investigating a phenomenon in its real-life context and answering "how" questions (Yin, 2014). A key characteristic of case study design is the use of multiple data sources (Guetterman & Fetters, 2018). The mixed-methods approach in this study involved both quantitative (complementary data collection tool) and qualitative methods for data collection and analysis (McKim, 2017), providing a comprehensive exploration of the research questions.

For the quantitative component, I collected survey data adapted from the RIA household survey, which measures variables such as internet access, device ownership, and digital usage patterns. Additionally, I introduced a cultural practices and processes module to assess the awareness, application, and preservation of cultural knowledge systems and their intersection with digital technologies. The survey data provided descriptive statistics, such as percentages and frequencies, which highlighted trends such as a decline in the frequency of specific cultural practices, like Letšema. Although I did not conduct a statistical analysis of the quantitative data, the survey results were analysed descriptively. The Ona.io data collection platform automatically generated numerical summaries of the data, which provided insights into key patterns, such as the decreased frequency of cultural practices. These quantitative results served as a starting point for further exploration in the qualitative phase of the study. Specifically, community workshops, interviews, and focus groups helped provide the context and explanation behind these trends. For example, while the survey indicated a decline in Letšema practices, the qualitative findings revealed that Letšema is embedded within other community activities, such as the Leola funeral scheme (discussed in Chapter 4).

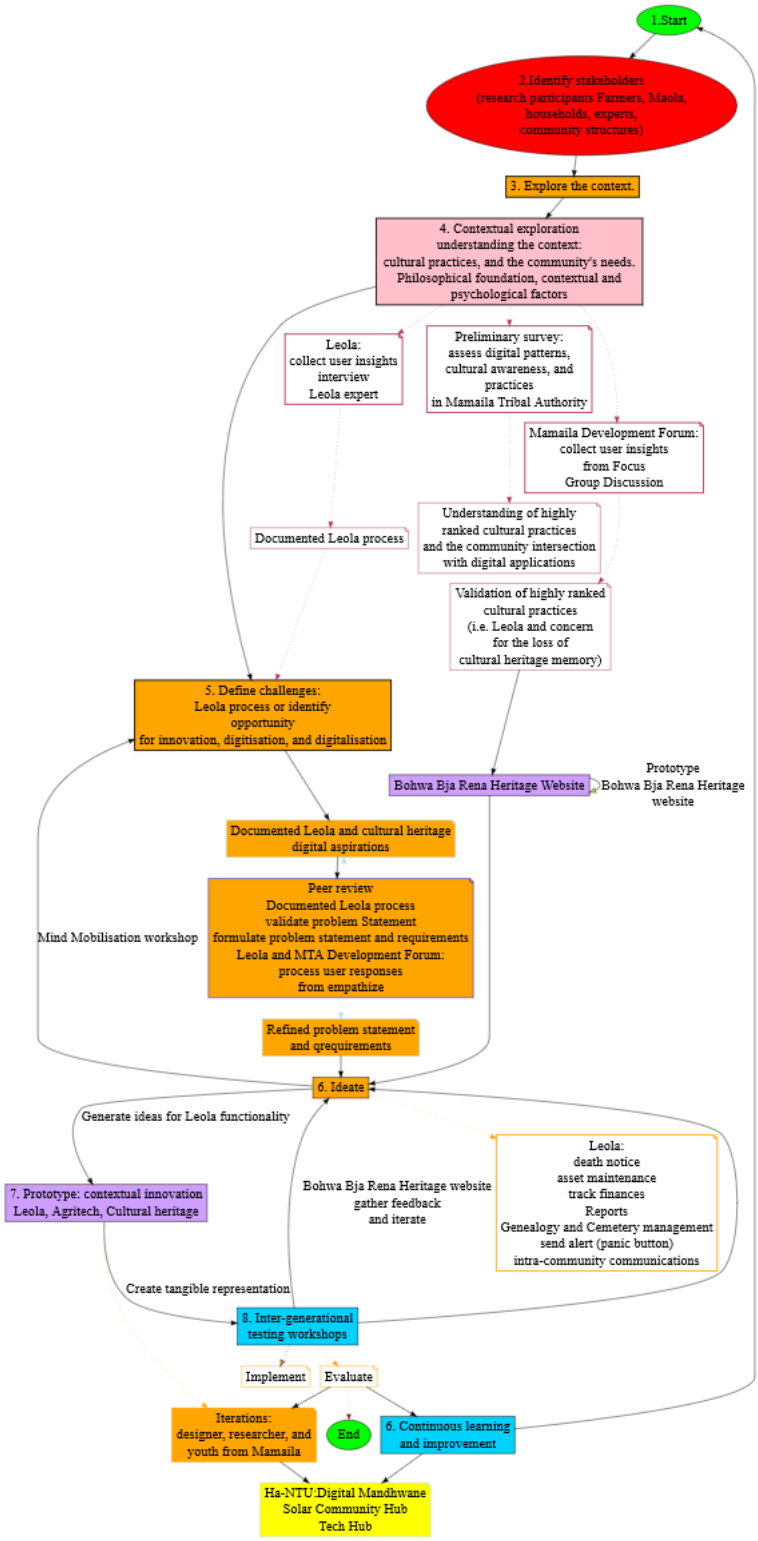
3.3.1 Action -research approach

Action research involves bringing people together to deal with specific management problems; people learn together, and the researcher is directly involved in this process (Howell, 2013). The methodological choice for this study is based on principles of inquiry and reflective practice and incorporates a transformative and advocacy lens (Menon & Hartz-Karp, 2020) drawing inspiration from Khumbane's philosophy of Mandhwane and mind mobilisation as

discussed in section 2.9. I employed action-research framed as a living ecosystem and collaborative learning environment as illustrated in Figure 3.3. Khumbane's Mandhwane and mind mobilisation integrate principles such as self-discovery, creativity, collective responsibility (Letšema), resilience, and reliance on indigenous knowledge systems to unlock contextual innovation while preserving cultural knowledge.

One of the critical elements of Mandhwane is the collaborative approach. Thus, one cannot engage in a Mandhwane process as an individual without the participation of others. I used a collaborative and reflective approach which involved co- creation and production of knowledge and co-design of the research artefacts. I started the research process by exploring the context, focusing on understanding the cultural practices and digital patterns in the community. This initial phase set the foundation for the subsequent stages which involved organising community workshops and co-creating the prototypes for the action research.

Figure 3-3: The Mandhwane action-research and co-creation process applied in the study

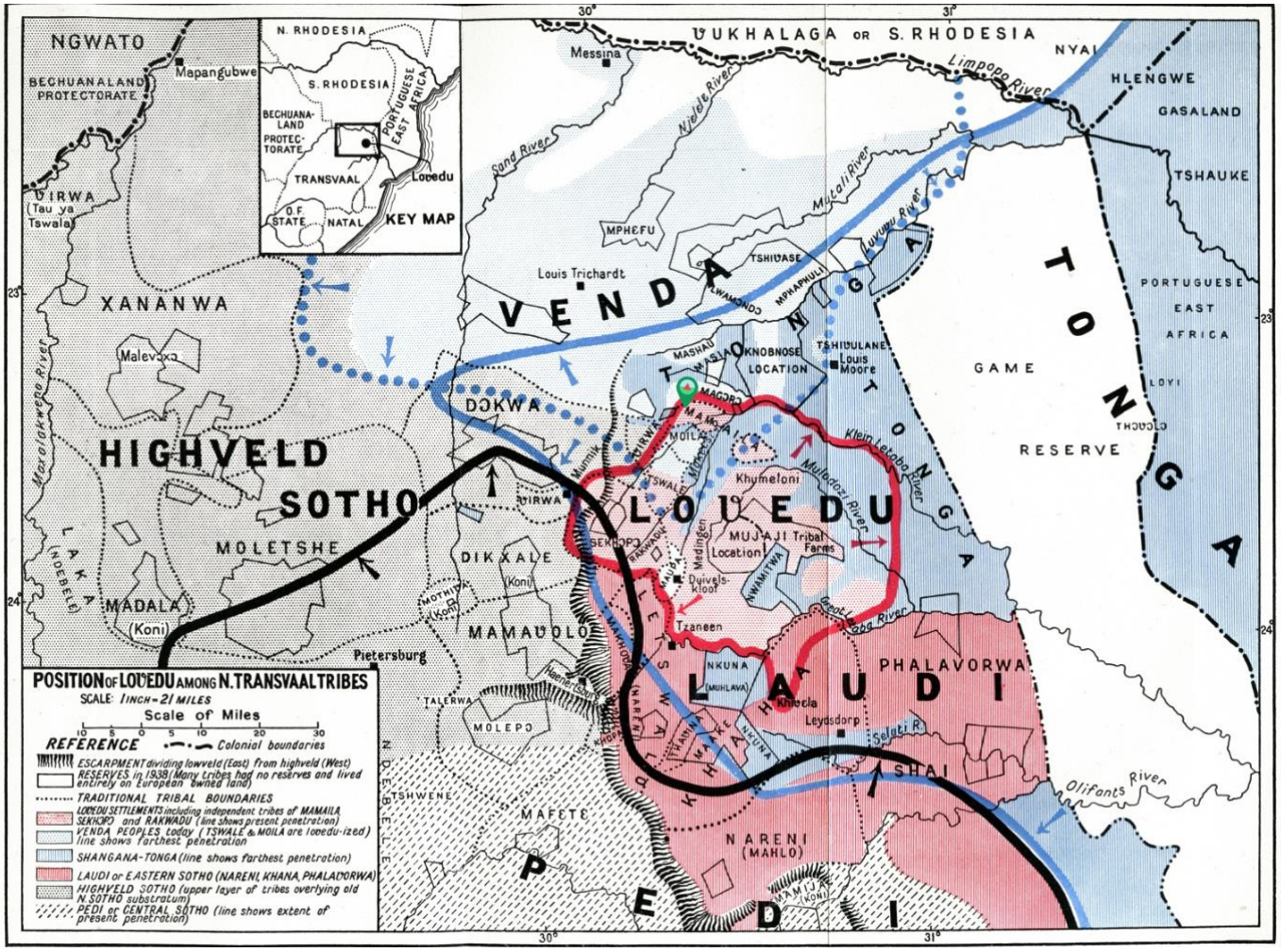


Note: This figure illustrates the adaptation of Khumbane's mind mobilisation approach applied in the research, indicating the iterative process and the co-creation of Mandhwane. Source: Author, 2024.

3.3.2 Case study selection and units of analysis

Researchers must be specific about their units of analysis in the targeted population as this determines what or who is being studied (Babbie, 2013). The units of analysis in a study refer to the entities or elements that researchers focus on to investigate and draw conclusions (Jornet & Damşa, 2021). The units of analysis for this study are Balobedu ba MTA, examined through five dimensions of the research analytical framework namely, cultural knowledge systems, practices, and processes; inclusive digital adoption and usage; digital skills; digital infrastructure; and digital leadership. The units of observation include cultural preservation, communal financial management systems, and agriculture. I selected the MTA as my unit of analysis because it was easily accessible. The MTA is one of the tribal authorities in the Sekgosese cluster in the Greater Letaba Municipality, Mopani District, Limpopo Province, South Africa. The community of Mamaila is part of the Balobedu under Queen Modjadji as illustrated in Figure 3.4. However, in the 1700s, the Balobedu ba Mamaila disassociated themselves from the Queen's dynasty to establish their settlement known as Mamaila Kolobetona.

Figure 3-4: Map of Lovedu, including the MTA



Note: This figure illustrates the location of the Lovedu among the former Northern Transvaal tribes and the location of the MTA, marked with 📍 (Krige & Krige, 1943, p. 336).

There are six villages in the MTA: Mamaila Kolobetona, Lemondokop, Sephukubje, Roerfontein, Chabelane, and Vaal Water. The MTA has over 5,500 households (StatsSA, 2016). Additionally, an understanding of the context, social structures and history of the organisation is crucial for researchers (Stockdale & Standing, 2002). The totem of Balobedu ba Mamaila Kolobetona is Kolobe (warthog), hence the name Mamaila Kolobetona (the great warthog). The Khe (Lo)bedu language spoken in the MTA differentiates the community of Mamaila from the Balobedu of Ga-Modjadji, as they have lost the original KheLobedu accent because they assimilated with the Venda, Baberwa, Phooko, and Tsonga communities. Furthermore, KheLobedu is not an official language of South Africa. Therefore, Balobedu children speak Se/KheLobedu at home and learn Northern Sotho at school.

3.3.3 Data collection instruments and community data collection instruments and engagement process

Once a researcher identifies their units of analysis, they need to decide on the tools to collect the required data. Case study evidence can come from various sources, which could be used collectively to improve the quality of the evidence (Yin, 2014). In this study, I employed a mixed approach to data collection using secondary and primary sources. Secondary data sources included government documents, while primary data sources included vital informants who participated in the household survey, focus group discussion, interviews, community workshops, and observations. The research drew insights from a total of 141 participants, including the document analysed. The data collection process involved four stages, with each stage providing me with valuable insights that built upon the previous one. Therefore, I carried out the research as an iterative process that involved working with the research respondents as co-creators and active participants in the construction of the reality of contextual DT and innovation (see Appendix C).

a Macro and meso-level expert interviews

Researchers conduct interviews when the research objectives centre on understanding experiences, opinions, attitudes, values, and processes (Rowley, 2012). Semi-structured interviews are a valuable qualitative research method, known for their flexibility and ability to elicit rich and context-specific information from participants (McIntosh & Morse, 2015). According to these authors, semi-structured interviews and open-ended questions offer a unique balance between guidance and participant freedom, making them particularly effective for exploring diverse perspectives and complex topics. Therefore, semi-structured interviews are well-suited to exploring interdisciplinary and multifaceted topics, gaining in-depth qualitative insights, and accommodating a diverse group of experts with varying perspectives and experiences.

The rationale for conducting expert interviews was to gain expert perspectives to understand the different aspects of the research dimensions and how that intersected with the cultural knowledge systems, practices and processes as well as to gain insights into the broader policy, regulatory, and institutional contexts in shaping contextual DT. I interviewed an interdisciplinary team of experts and practitioners encompassing African cultural knowledge systems, DT, software engineering, agriculture, policy, and regulation. In total, I conducted 18 expert interviews representing the macro- and meso-level perspectives, as shown in Figure 3.5. The interviewees included representatives of the

House of Traditional Leaders, farmers, digital entrepreneurs, ICT4D practitioners, and policy and regulatory experts. I asked all experts related questions based on the sector or domain (cultural heritage, digital transformer, innovator, farming, policy, and regulation), to explore the interdisciplinary nature of the research and intersection with technology and cultural knowledge systems. Employing the same questionnaire guide tailored to specific domains contributed to the consistency and the internalisation of the narrative from diverse perspectives (see example in Appendix D). I conducted the interviews via Zoom, as data collocation took place during the 2020 COVID-19 lockdown period.

Figure 3-5: Macro- and meso-level perspectives



Note: Pseudonyms for the research respondents were extracted from the ATLAS.ti software.

b Macro-level document analysis

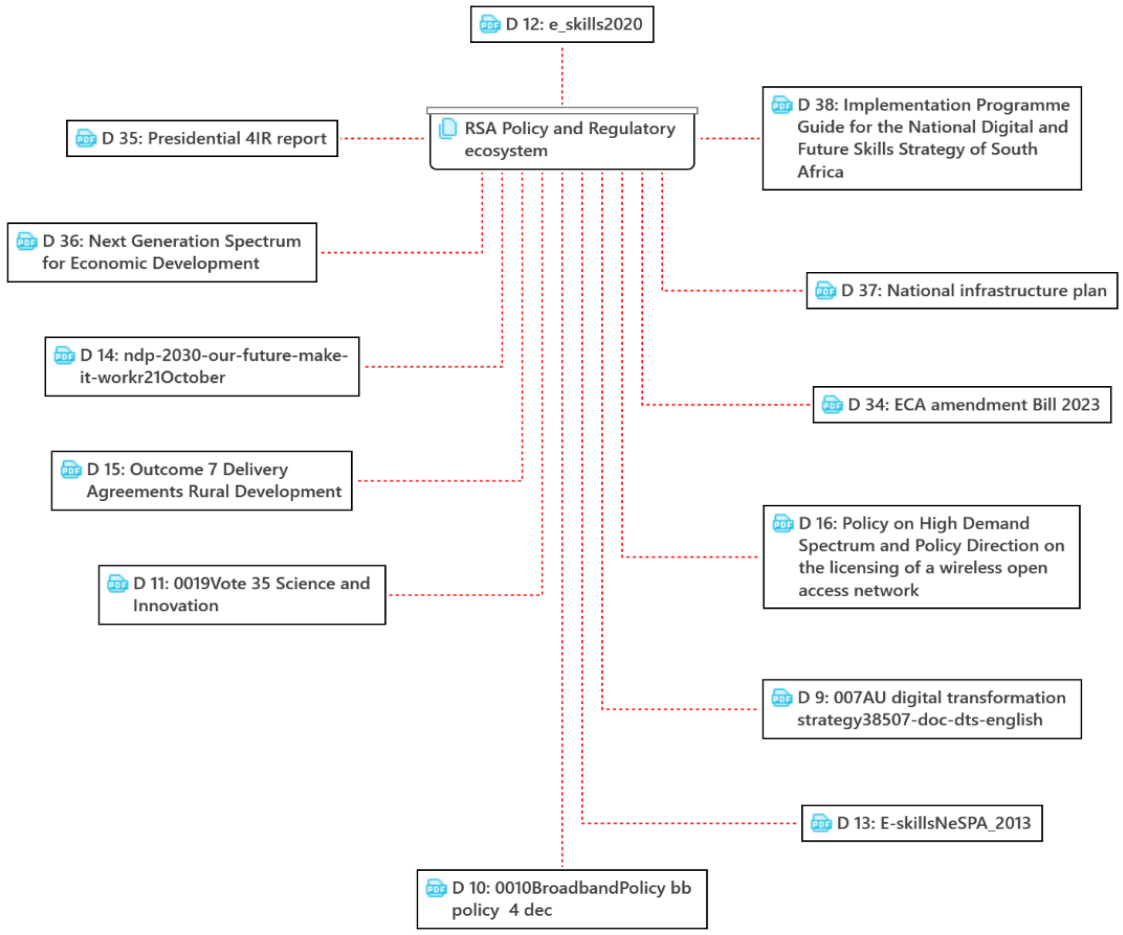
Document analysis is a systematic process for examining or appraising various types of documents, including both physical print and digital materials, such as those stored on computers and transmitted over the Internet (Bowen, 2009). Public or institutional records include policy manuals, handbooks, official transcripts and course records, institutional self-study reports, programme review reports, meeting minutes for standing committees, institutional plans, public records, annual reports, and research reports, among others (Billups, 2021). I reviewed government publications that represent the national and African continent perspectives. Figure 3.6 shows the 13 documents that I regarded as relevant for further analysis. I included the AU's DT strategy to assess the alignment between the South African vision and the continental vision. Document analysis can be valuable for novice researchers because "when used to analyse pre-existing texts, this method allows researchers to conduct studies they might otherwise not be able to complete" (Morgan, 2022, p.64).

Documents analysis serves multiple valuable functions, including examining policy content throughout different

periods and geographical locations, recording procedural details, corroborating findings with interviews and alternative data sources, comprehending the formal presentation of information and ideas, and gaining insights into how issues are framed, among various other applications (Dalglish et al., 2020). For instance, in this study, the analysis of documents provided an in-depth contextualisation of the study offering a timeline of South Africa's journey on DT.

I analysed the extent to which the South African policy and regulatory environment considers a cultural approach as a strategy to unlock collective human capabilities for inclusive and active participation in DT. I also assessed the budgets, strategies, policy, and regulatory framework to enable a people centred DT in the South African context.

Figure 3-6: Government documents analysed by the researcher



Note: The Atlas.ti figure illustrates the selected documents analysed.

Micro-level perspectives: Community engagement process

I employed a community-based approach to data collection to ensure that the study was grounded in the lived experiences and cultural contexts of the participants. The primary methods used included micro-level expert interviews, focus group discussions, mind mobilisation workshops, solutions testing workshops, and household surveys. These methods were designed to complement each other and collectively contribute to the co-creation approach employed in the research.

c Focus group discussion

A focus group discussion (FGD) (see Appendix E) allows the researcher to interview several individuals systematically and simultaneously (Babbie, 2013). Researchers must gather six to twelve homogeneous people for about 90 minutes of discussion, facilitated by a moderator who can manage the group dynamics (Neuman, 2011, p. 412). I conducted one focus group discussion with representatives of the Mamaila Community Development Forum, the rationale was to obtain their perspectives on socio-cultural and technological interactions in the MTA. The focus group discussion with the Mamaila Community Development Forum and the Mamaila Royal Council representatives took place on 6 October 2020. Seven representatives participated in the discussion consisting of two ward councillors, a teacher, a principal, a member of the Mamaila Royal Council, a representative of the Leola funeral scheme executive member, and a local journalist. The insights gained from this focus group discussion were pivotal in understanding the broader socio-cultural and technological dynamics within the Mamaila community.

d Micro-level expert interviews

I conducted a face-to-face interview with a representative of one of the executive committee members of the Maola groups in MTA to document the Leola funeral scheme process. The rationale was to explore collective capabilities and how cultural practices and processes such as Leola could benefit from digitalisation. Leola is a communal funeral scheme in the MTA that provides both financial and non-financial support to bereaved families, discussed in detail in chapter five. I also interviewed a local farmer who is the chairperson of the farming association in Limpopo Province and a member of the Greater Letaba Municipality Farmers' Forum. The rationale was to explore the intersection of cultural knowledge systems within the farming ecosystem and to assess the uptake and usage of technology by local farmers and the potential for digitalisation. The farmer also participated in the mind mobilisation workshop, and I visited his farm on several occasions for observations. These interviews provided critical insights into how cultural practices and community-driven initiatives, such as Leola and local farming, can be enhanced through digitalisation.

e Mind mobilisation workshop

African scholars using the Afrocentric research method should focus on the African cultural reality (Mkabela, 2005). In line with this perspective, I used storytelling to engage with the research respondents and to gain insights into their experiences and the realities of the socio-technical interaction in their context. I organised a mind mobilisation (see Appendix F), workshop held on 6 April 2021, at the Mamaila tribal offices. Attended by fifteen representatives from the Maola groups, including members from the Mamaila and Sephukubje villages, along with a commercial farmer, and members of the Mamaila Royal Council and Tribal Authority participated in the workshop. I incorporated storytelling in the workshop, facilitated through the seasonal calendar (see Appendix G), to explore and gain insights into the day-to-day communal practices and processes organised according to the different seasons. The rationale for the mind mobilisation workshop served as the second phase of data collection, building on the insights gathered from the FGD. This phase facilitated deeper community engagement through design thinking techniques, and the insights gained were used as inputs for the Mandhwane phase (prototype design).

The rationale for integrating the seasonal calendar was to gain an understanding of events that happen in the community concerning cultural knowledge systems, processes and practices. The information gathered enabled the identification of processes and practices that might benefit from digitalisation. The use of a seasonal calendar further provided insights into what the community valued in terms of their cultural heritage and how they perceived the role of technology in their practices. I also used the workshop to validate the household survey findings as a form of data triangulation and the Leola process as illustrated in Figure 3.7.

Figure 3-7: mind mobilisation participants discussing and presenting the seasonal calendar



Note: This figure illustrates the validated and improved Leola process based on feedback from the mind mobilisation workshop. The figure also illustrates the survey that was reviewed by the workshop participants as well as the recommendations and the intergenerational discussions and report-backs from the mind mobilisation workshop.

The storytelling approach allows the research participants to control the dialogue, and the stories can unlock the cultural modes of the research participants, representing everyday theories about the world (Davis, 2007). During the workshop, I used proverbs, totems, and praise songs to build rapport with the community, allowing for a narrative on the loss of cultural heritage to unfold and how technology could be used to preserve knowledge for the benefit of future generations. The information and feedback collected during the workshop informed the planning of the next phase, where the research participants actively engaged as co-creators in developing and testing the research prototypes.

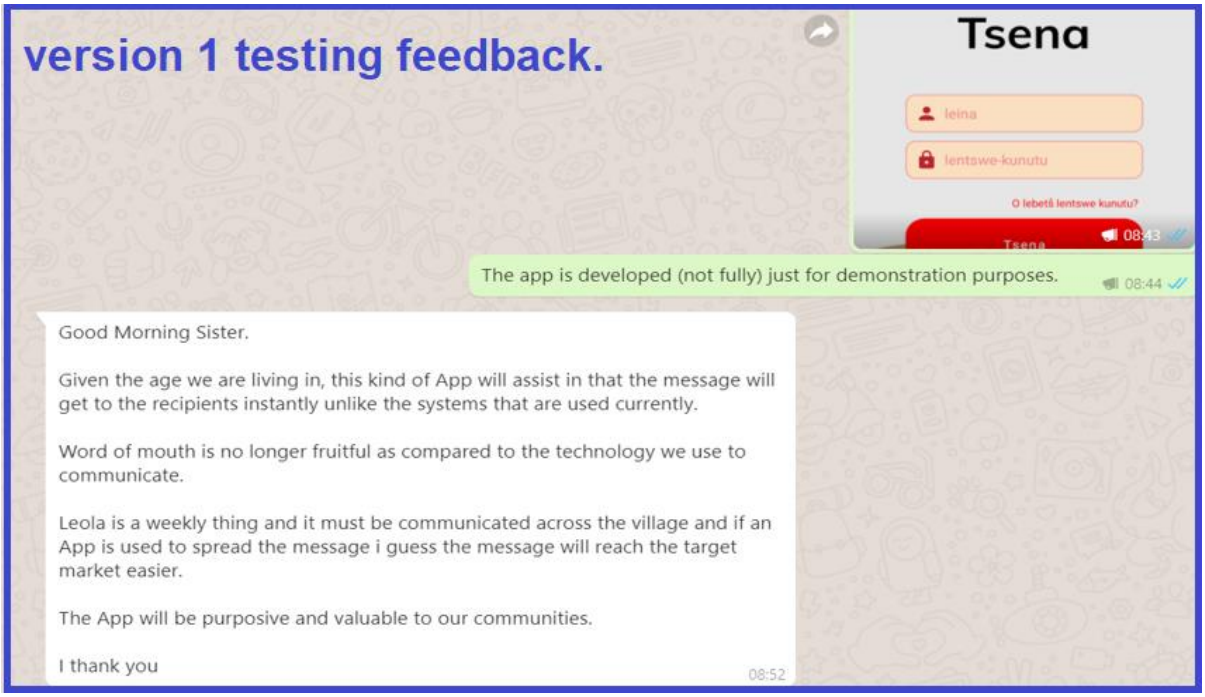
f Observations: Digital solutions (prototype) Mandhwane phase and testing workshop

A case study should take place in the real-world setting of the case because this provides the opportunity for direct observation (Yin, 2014). Direct observation is a relevant data collection tool for gathering evidence on how the targeted units of analysis interact and experience innovation (Neuman, 2011). The rationale for the Mandhwane phase was to directly involve community participants in the design and testing of digital prototypes. This phase emphasised the principles of learning by doing. I conducted several direct observations in the real-world setting, particularly during the mind mobilisation and solutions testing workshops. During these workshops, participants interacted with the prototype for the cultural preservation website (browsing and contributing content).

In July 2021, I conducted the initial testing phase for version 0.1 of the Leola prototype, targeting the youth from the MTA. The objective was to assess the usability of the prototype among those who were digitally inclined. I conducted the initial testing phase by reasoning that any difficulties encountered by this group would indicate the potential challenges that the intended users, the Maola groups, might also face. During this testing phase, I gathered feedback from the testers, and some offered input enhancing the prototype's functionality, making it more user-friendly and meaningful for Baby Boomers and Generation X.[10] Testers gave feedback highlighting the potential benefit of digitalising the Leola processes, as captured in Figure 3.8.

[10] In this study Baby Boomers and Generation X are referred to as "Bagolo (the Elders)".

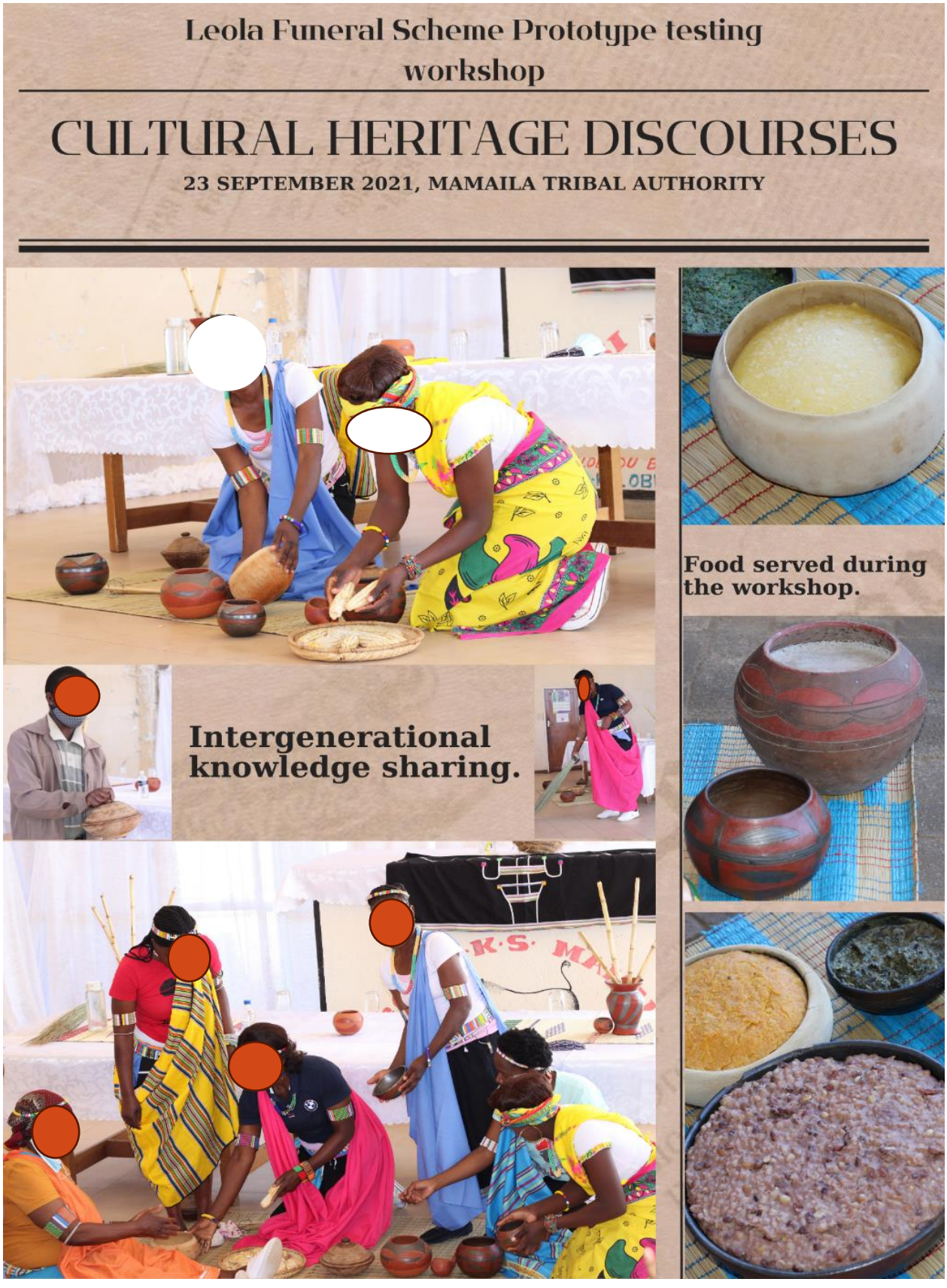
Figure 3-8: Example of user feedback on version 1 of the prototype



Note: This figure captures feedback on version 1 of the Leola prototype. The feedback from the user demonstrates that the tester values the role of technology in managing the Leola process and intra-community communication.

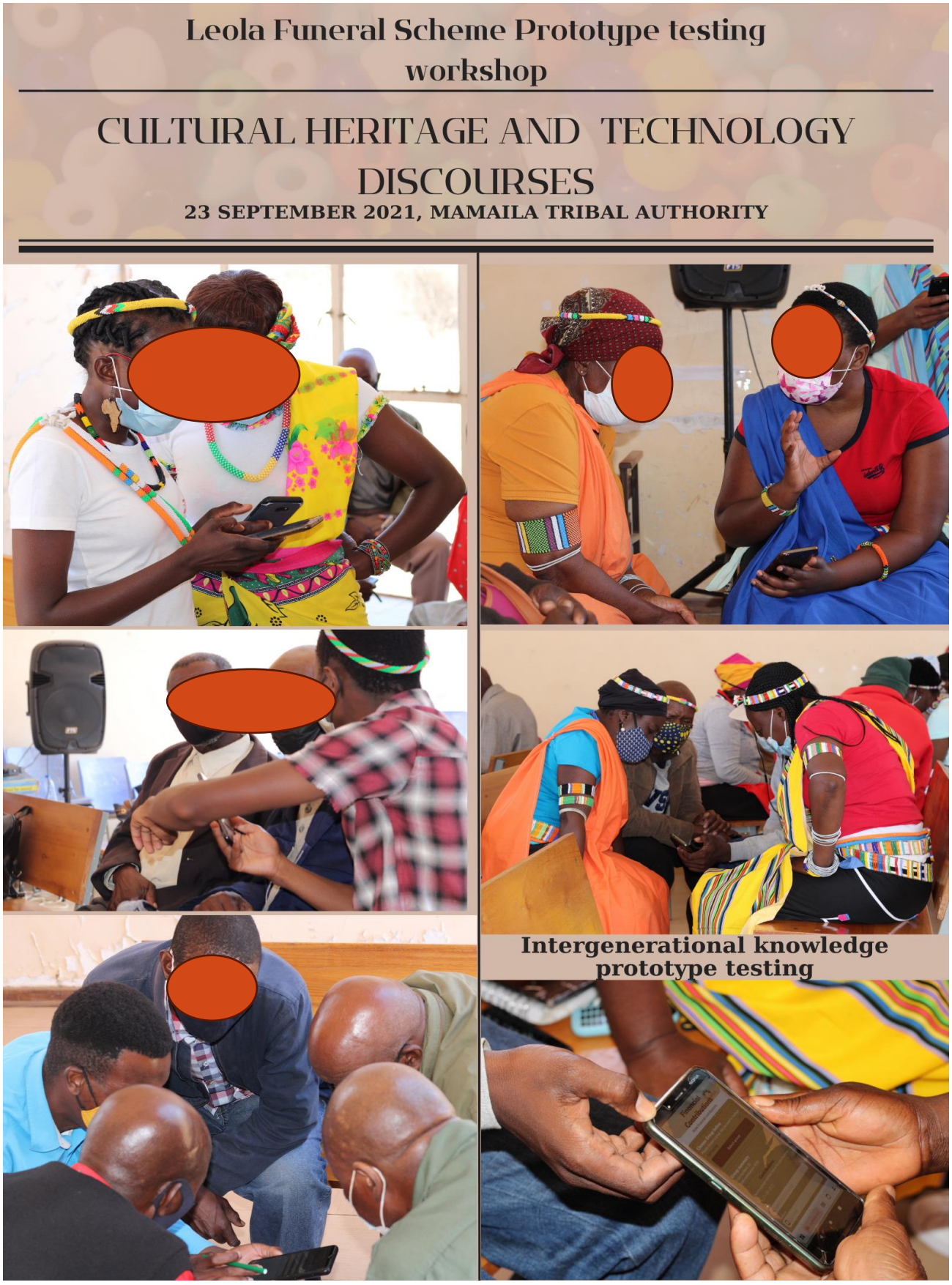
The digital testing workshop, framed as a Mandhwane workshop and a celebration of Heritage Day, took place on 23 September 2021, as illustrated in Figures 3.9 and 3.10. At the workshop, two members of the Leola funeral scheme attended with their children. One of the children actively participated in the app's development, providing ongoing input on functionalities, and testing each module. Since most Maola executive committee members are older people who do not own smartphones, the young people at the workshop demonstrated the app and explained its functionalities. During this testing phase, I gathered feedback from the testers, and some offered input enhancing the prototype's functionality, making it more user-friendly and meaningful for older people.

Figure 3-9: Digital solutions testing workshop focusing on the Leola funeral scheme prototype



Note: These figures illustrate the setup during the digital testing solutions workshop.

Figure 3-10: Intergenerational digital solutions testing session (Leola funeral scheme prototype



Note: This figure illustrates the different testing sessions facilitated by youth from Mamaila village together with the representatives of Maola groups.

The purpose of the workshop was to present the prototype, gather user input, and determine the level of willingness to accept and use the prototype (see Appendix H). Collaborating with the research respondent who participated in the mind mobilisation workshop, we themed the app testing workshop as a cultural heritage celebration, a day before Heritage Day. The theme stimulated conversations about the role of culture and heritage expressed through clothing, cultural artefacts, and the traditional food system.

The workshop was attended by over 35 people of different ages, ranging from 22 years to over 70 years. I started the session by asking the participants to introduce themselves with their totems and praise songs. I framed the conversation as revisiting childhood, by asking the participants if they remembered Mandhwane and what they did during Mandhwane. This was an enlightening session that broke the ice as the elderly people did not anticipate that they would be taken back to their childhood days. The elderly gladly shared what they remembered about Mandhwane, indicating that it was a place where they learned skills and how to be responsible by creating their houses, taking care of imagined livestock, cooking, and imitating parental roles. I concluded the scene-setting session by emphasising that the workshop was a Mandhwane that involved technology to allow the participants to be free in expressing themselves. The setup of the workshop and lunch unlocked conversations about the loss of the cultural food system. During the lunch conversation, the elders shared the names of the traditional meals and recipes with the younger participants, thus serving as an educational and knowledge exchange platform.

g Household survey

Surveys are appropriate for research questions about self-reported beliefs or behaviour (Neuman, 2011). Cultural knowledge systems are about the beliefs and behaviour of communities or nations influenced by their worldviews or life philosophies. With permission granted by Research ICT Africa (RIA), I adapted the RIA household survey to suit the specific geographic location and contextual requirements of the research. To ensure alignment with the research analytical framework, I organised the RIA questions into different modules. Specifically, I grouped certain questions to develop the inclusive digital adoption and usage module for the survey. Additionally, other questions were allocated to the digital infrastructure module to ensure consistency with the research analytical framework. The RIA modules covered demographics of randomly selected individuals, household Internet access, mobile money, and computer/phone and Internet/World Wide Web usage. The added modules addressed cultural practices and processes, inclusive digital adoption and usage, digital skills, Mandhwane and mind mobilisation, digital infrastructure, and digital leadership. The rationale for using the household survey as a complementary quantitative method served as a preliminary tool, rather than a primary data collection method, to assess the AS-IS status of the action-research environment helping to inform subsequent phases of the study..

g (a) Population and sampling

Siegel and Wagner (2022) define a population as any collection of units that researchers are interested in, and a sample as a smaller collection selected from the population to be representative of its characteristics. MTA has a total

of 5,500 households across six villages. Due to resource constraints, I targeted a sample of 326 households from the two villages, which constitutes a smaller subset of the total population of 3,132 households across MTA. Mamaila which is the old settlement, and the headquarters of the Tribal Authority has 2,517 households and Roerfontein (615 households). I employed a cluster sampling technique by dividing each village into five sections (clusters), from which 10 households were randomly selected to participate in the survey, ensuring a representative distribution across each section.

In terms of probability sampling, each household had an equal chance of being selected for the survey, as the selection within each section was random. This approach ensured that the sample was representative of the population of the village. Initially, I relied on Google Maps to map the households, but its accuracy was sometimes questionable, particularly in distinguishing between residential and non-residential areas. To address this, I introduced a manual verification step. For Mamaila, I used my local knowledge, while for Roerfontein, a local research assistant helped cross-check the households.

While this sample was intended to provide insights into the population, the relatively low response rate of 15.7% (51 out of 326 households) which translates to approximately 1.6% of the total population in the two villages limits the generalisability of the survey findings. Given the low response rate to the survey, I complemented the quantitative data with insights from community interviews, focus group discussions, and community mind mobilisation workshops. These qualitative methods provided additional context and depth, enabling a more comprehensive understanding of the issues at hand. To further enhance the credibility of the survey results, participants from the workshops were also involved in reviewing and validating the findings. The convergence of evidence from these multiple sources allowed for a more nuanced interpretation of the data. As Yin (2014) asserts, the use of multiple sources of evidence, such as survey data, focus group discussions, and community workshops, enhances the validity and reliability of research findings. In this study, data triangulation contributed to a more robust and credible interpretation of the results.

g (b) Piloting and administering the survey

I conducted a pilot test of the survey tool with a group of selected participants from the MTA, as well as one individual from a different tribal authority. The testing group included both research assistants. Joey's active involvement in translating the survey from English to North Sotho (see Appendix I): Household survey Sepedi questionnaire) and in the pilot testing served as a valuable training experience for him, he subsequently trained the other research assistant, Manthole Mashala.

I administered the household survey between August 2020 and September 2021 in two of the six villages in the MTA, namely Roerfontein and Mamaila Kolobetona, supported by the research assistants. Initially, I designed the household survey as a self-administered hard-copy questionnaire. However, due to the COVID-19 pandemic and regulations, I converted the questionnaire into an online format using the Ona web form (see Appendix K). The online questionnaire allowed the research assistants to capture household data using mobile devices such as laptops and

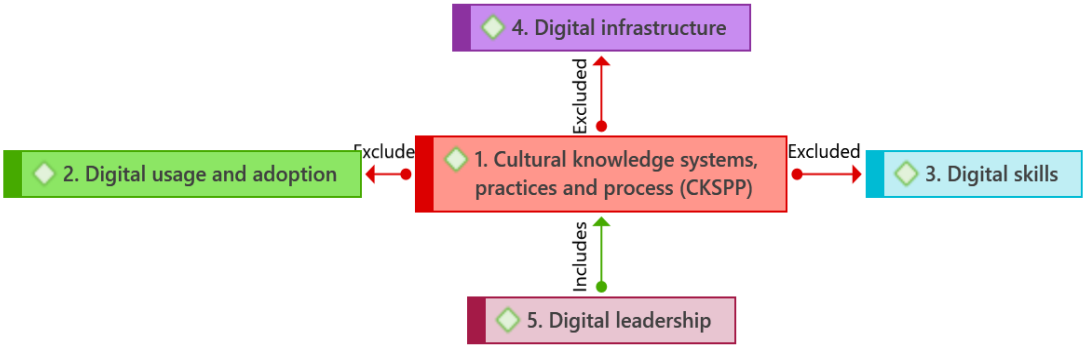
phones. The Ona website does not require Internet connectivity; as a result, the research assistants could capture the responses offline. The data collectors stored the completed surveys (individual questionnaires) in the device browser for later submission, and then automatically uploaded the forms to the ONA server whenever they connected to the Internet. After the respondents submitted the completed questionnaire, I ensured data quality control and maintained the confidentiality of the respondents by restricting the research assistants' access to the forms.

Collectively these data collection instruments provided me with a holistic understanding of the contextual systems, practices, processes, and their interaction with the meso and macro level perspectives. Each instrument provided complementary insights. These data sources were integrated during the analysis phase to create a comprehensive understanding of the case study as discussed in the section below.

3.4 Data analysis

Data analysis is a strategy used by researchers to search for patterns in data, recurrent behaviours, objects, and ideas (Neuman, 2011). Qualitative researchers must present the original ideas and views of the research participants without bias by applying a systematic and transparent approach to data analysis. I employed a blended approach to data analysis, combining elements of both deductive and inductive reasoning. I conducted a deductive analysis using the dimensions from the research analytical framework presented in Figure 3.13, which provided a structured foundation for organising and categorising the collected data, as well as visually representing the narrative emerging from the identified themes. This framework served as a guide in the initial stages of coding, helping to establish a coherent structure for the analysis. Additionally, I adopted an inductive approach, allowing for the emergence of new themes directly from the collected data. Both manual and computer-assisted data analysis (CAQDAS) techniques were employed in this dual-method analytical process. The interconnected components of the research analytical framework, as illustrated in Figure 3.11 provide an overview of the emerging narrative from the inductive data analysis.

Figure 3-11: Dimensions from the analytical framework and narrative emerging from the data analysis



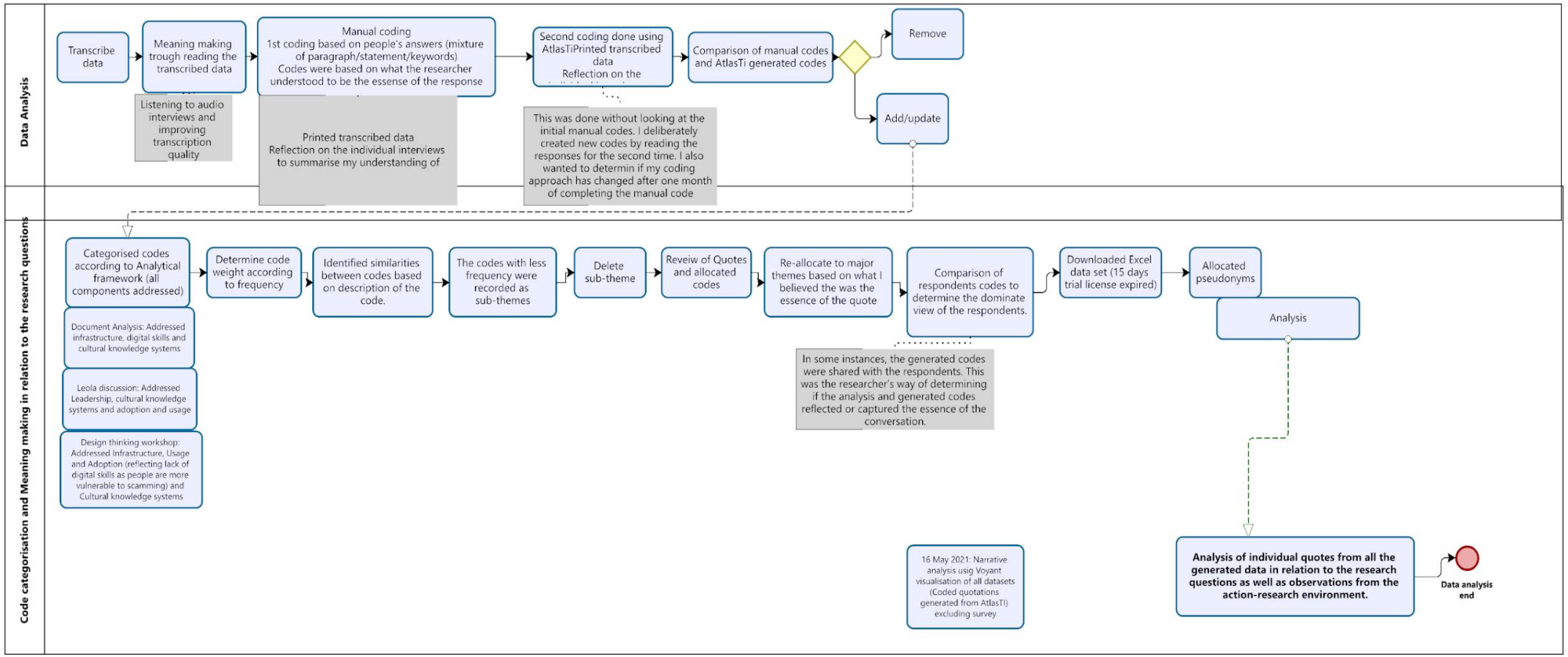
Note: The connections between the different components of the analytical framework were analysed using Atlas.ti to identify patterns and themes.

The advantage of using an analytical framework is that it ensures coherence and allows other researchers to replicate,

compare, and contrast the research findings (Thomas, 2013). Moreover, analytical frameworks help to organise research and provide a general list of areas or variables used in any analysis (Coral & Bokelmann, 2017). I used the inductive approach to guide the examination of codes and theme relationships using Atlas.ti CAQDAS. The structured framework ensured coherence and allowed for the identification of recurring patterns, themes, and the interplay between them. The framework method offers a systematic approach for generating well-organised summaries of data. This method involves a structured process that arranges codes into groups, grouping them by related ideas or concepts (Gale et al., 2013).

Researchers use coding to organise and group data with similar codes based on shared characteristics; the first coding cycle can vary in scope, ranging from a single word to a full sentence (Saldana, 2009). I commenced with data analysis in October 2020 with the transcription of the interviews, focus group discussion, and mind mobilisation workshop, as shown in Figure 3.12. Using an audio recorder for face-to-face interviews and Zoom for virtual interactions, I captured diverse data. Subsequently, I engaged in a meaning-making and reflection process by reading the transcribed data and listening to audio interviews to enhance transcription quality. This was followed by manual coding and a process of reading the transcriptions, journalling what I understood to be the essence of the responses, and then allocating codes based on my understanding of the responses. I conducted a second coding cycle using Atlas.ti, without referring to the initial manual codes to test and assess the consistency of my meaning making process. I later compared the manual and Atlas.ti-generated codes, resulting in the adjustments of codes based on the comparison. I then categorised the generated codes according to the analytical framework.

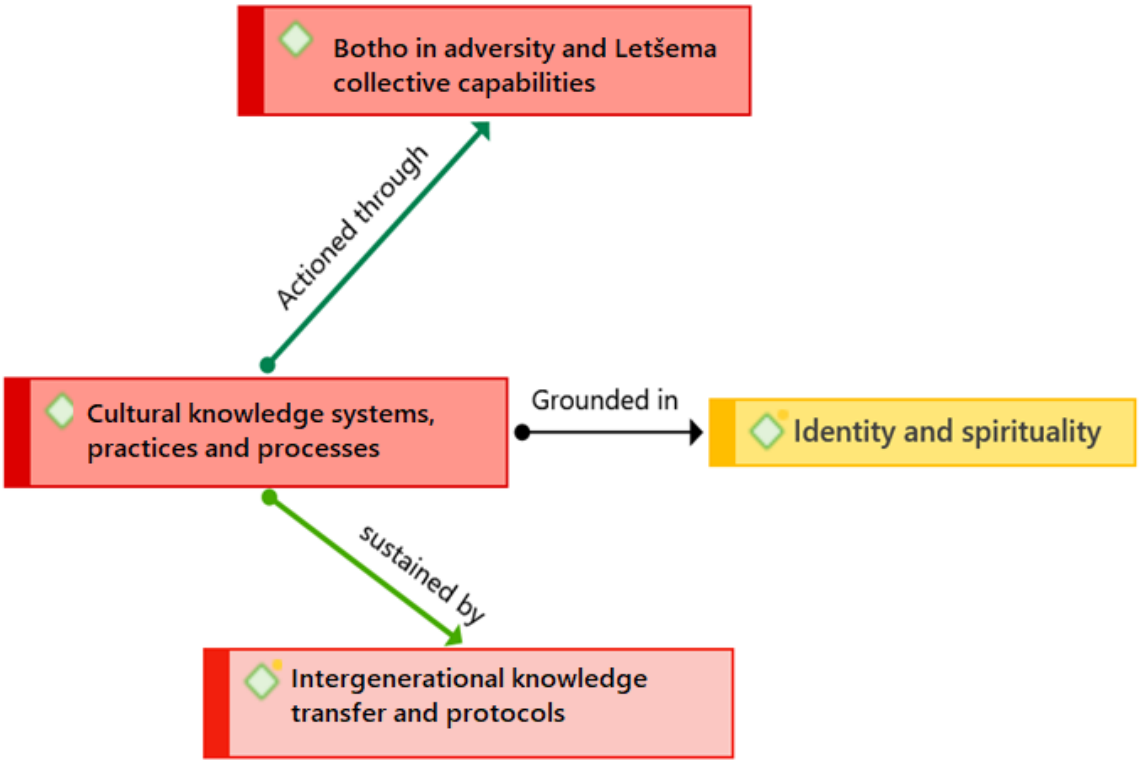
Figure 3-12: Qualitative data analysis process



Note: This figure illustrates the inductive data analysis processes undertaken in this research. Source: Author, 2024.

I later reviewed and grouped the codes according to emerging themes based on the perceived essence of the quotes. For example, I kept the broader category of cultural knowledge systems and then generated the following themes: Botho in adversity and Letšema collective capabilities, identity and spirituality, and intergenerational knowledge transfer[11] and protocols, as captured in Figure 3.13.

Figure 3-13: ATLAS.ti generated themes based on the codes emanating from the dataset

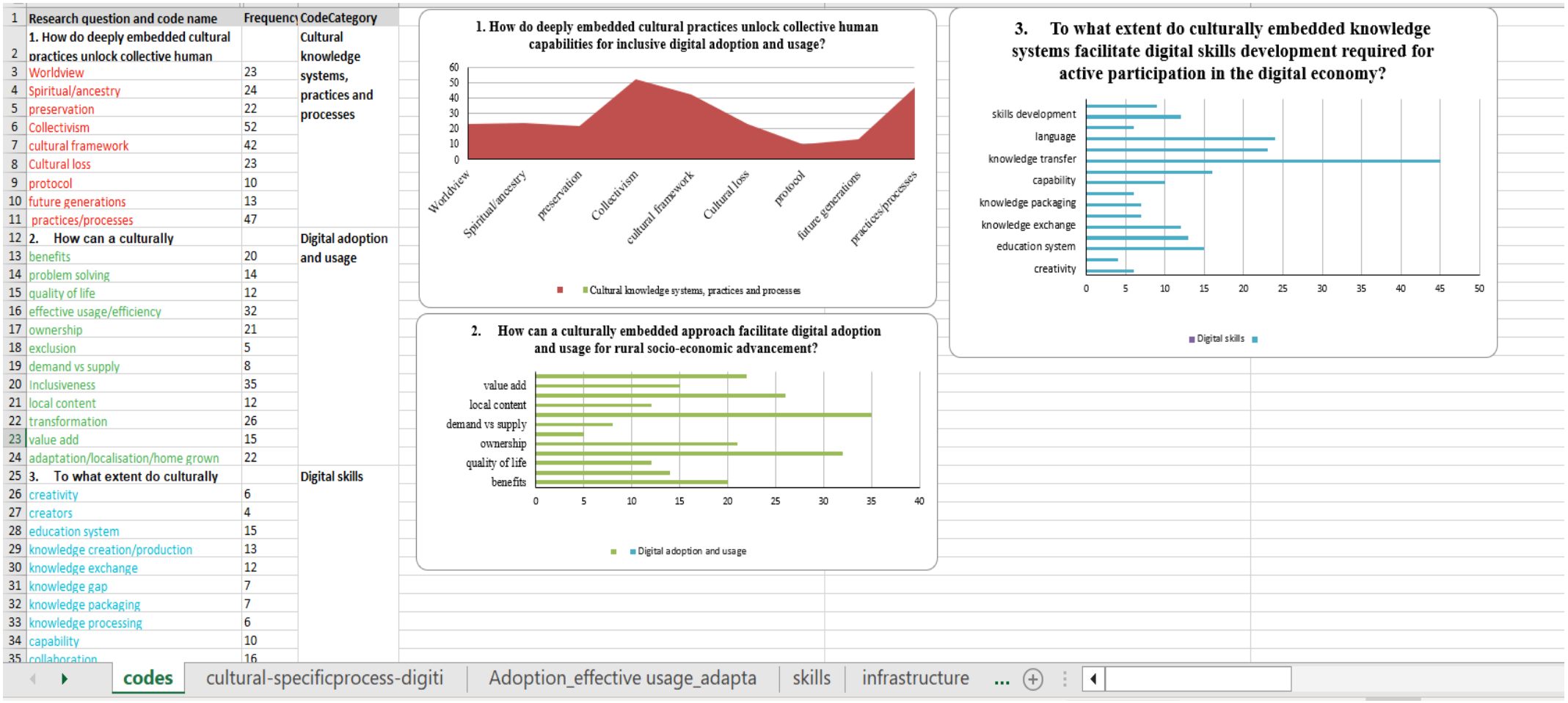


Note: This Atlas.ti figure illustrates that CKSPPs are interconnected systems rooted in identity and spirituality, transferred from one generation to another following prescribed protocols, actioned through Letšema collective capabilities, and Botho in adversity.

I also compared the generated codes, as shown in Figure 3.14 and Figure 3.15 to determine the groundedness of the emerging themes.

[11] Holistic, communal, and forward-looking methods for transferring cultural wisdom and practices from one generation to another.

Figure 3-14: The initial codes generated from the respondents



	Research question and code name	Frequency	CodeCategory
2	1. How do deeply embedded cultural practices unlock collective human		Cultural knowledge systems, practices and processes
3	Worldview	23	
4	Spiritual/ancestry	24	
5	preservation	22	
6	Collectivism	52	
7	cultural framework	42	
8	Cultural loss	23	
9	protocol	10	
10	future generations	13	
11	practices/processes	47	
12	2. How can a culturally		Digital adoption and usage
13	benefits	20	
14	problem solving	14	
15	quality of life	12	
16	effective usage/efficiency	32	
17	ownership	21	
18	exclusion	5	
19	demand vs supply	8	
20	Inclusiveness	35	
21	local content	12	
22	transformation	26	
23	value add	15	
24	adaptation/localisation/home grown	22	
25	3. To what extent do culturally		Digital skills
26	creativity	6	
27	creators	4	
28	education system	15	
29	knowledge creation/production	13	
30	knowledge exchange	12	
31	knowledge gap	7	
32	knowledge packaging	7	
33	knowledge processing	6	
34	capability	10	
35	collaboration	16	

Note: This figure illustrates the initial codes data generated from the datasets and used to develop the themes.

Yin (2014) posits that CAQDAS is a tool that assists researchers in analysing data without analysing it on behalf of the researcher. Therefore, researchers cannot use the outputs as the end of the analysis. Researchers must engage in an iterative process to study the outputs to determine whether meaningful patterns emerge. Yin encourages researchers to "play" with their data to search for patterns and insights, including comparing data from diverse sources. I conducted data analysis as an iterative process. The data analysis process included a comparison of the respondents' codes to determine the dominating views. In addition, I downloaded the Atlas.ti datasets for further analysis on an Excel spreadsheet by reflecting on the research question, respondents' quotes, and what I understood to be the essence of the response concerning the research question for all the research respondents. Figures 3.15 in conjunction with the insights derived from Appendix L, and Appendix M: the frequency of codes used to develop the themes emerging from the data, collectively exemplify the application of grounded theory principles in my inductive data analysis. These visual representations serve as tangible artefacts of the iterative and exploratory nature of the grounded theory approach. Through systematic coding, comparison, and reflection, these figures illustrate that I allowed the themes and patterns to organically emerge from the data, mirroring the core tenets of grounded theory methodology.

Figure 3-15: Data analysis meaning making, and my reflection on the generated codes

Respondent	Quotation	Codes	Comment	Research question	How does it answer the
Professor of African Philosopher and software engineer (Xolani)	You see how it works now, this comes back to what I was trying to tell you to say the Basotho doctoral knowledge has a very interesting strategy where instead of focusing on the details they focus on the substance you see. Culture is like that. Cultural knowledge is like that. Culture tends to focus more on the essence. For example, things like rituals, socialization, language, relations, lekgotla and stuff like that. So, I will like to say that cultural practices have to be deeply embedded, that's very important and the only way they can become deeply embedded is when they are taught at a very young age. That's very important. And these deeply embedded cultural knowledge and practices can unlock the collective human capabilities because Basotho have this expression and all nations in SA they have the expression that says Motho ke motho ka batho. That addresses the aspect of collective human capability. When you look at the way the African society is organized you have a family, clan, and then you have a nation. The nation is a collection of clans. The clan is a collection of families. And here we talk about extended families. So, this is a very important part. So, when we talk about collective capabilities that also implies that culture is also like a glue or it is an aggregator. It aggregates the different members of society together. So that they become a cohesive unit. Cohesive organization. One of the capabilities of cultural knowledge is what I like to refer to as enterprising culture, this would be more like a business culture. (For example, by way of comparing SA and Jews, Indians, Whites and even Nigerians, West Africans, SAs get overrun by this nation and the reason being that the other people have an enterprising culture which is deeply embedded cultural practice, a deeply embedded cultural knowledge, they learn at a very young age the concept of an enterprise.	Capability, practices/processes, Collectivism, future generations, knowledge transfer, cultural framework	African society is structure (family, clan, nation) . supports lilian and Solomon. culture is a glue/aggregator. supports Eyram's point. risk taking requires an enterprising culture and this is embedded in nations such as Nigerians. It is must consistent and continuous.	Q2: How can a culturally embedded approach facilitate digital adoption and usage for rural socio-economic advancement?	Social structure is part of the collective capabilities. Collective capabilities require the contribution of different people. In an African context the Letsea practice is a form of collective capabilities.

Note: This figure illustrates the process I followed in making sense of the research data, meaning making, and my reflections on the generated codes concerning the research question.

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Lastly, the survey data was automatically analysed through the Ona.io generated charts based on the frequency of I engaged with the survey analysis on an ongoing basis to identify corrupted or lost data whenever the graph indicated NULL responses. Furthermore, I organised the data by grouping and categorising related questions and responses according to the research analytical framework. The grouping enabled me to get a holistic view of the data and to establish the relationship between questions in the same categories.

3.4.1 Reliability and validity

Case study researchers are often criticised for biases as they fail to ensure that the research design meets the tests of trustworthiness, credibility, confirmability, and data dependability. According to Yin, there are four tactics – construct, internal, external validity, and reliability – that researchers could apply to improve the quality of their case studies (2014, p. 45). On the other hand, Howell (2013) posits that in constructivist research, reliability and prediction are almost impossible, and cause and effect are difficult to identify. Therefore, reality is relative, and meaning can vary across contexts because it is not universally fixed. Moreover, Golafshani (2003) posits that reliability and validity are about trustworthiness, rigour, and quality in the qualitative paradigm. However, despite the context-specific nature of meaning-making, scholars agree that researchers can improve credibility and trustworthiness by using multiple data collection tools, involving participants, and seeking feedback from participants to enhance the rigour of their findings.

To improve the credibility and trustworthiness of the results, I used multiple data collection tools as discussed in the previous sections. Moreover, the mixed-method case study approach resulted in the convergence of evidence demonstrated by the corroboration of views from expert interviews, the focus group discussion, the household survey, and the community workshops. In some cases, I shared the generated codes with the respondents to determine if the analysis and generated codes reflected or captured the essence of the conversation. The convergent evidence and data triangulation help to strengthen the case study's construct validity (Yin, 2014). I also employed triangulation during the data analysis phase to ensure the credibility and trustworthiness of the study. The data triangulation process that I followed included data visualisation techniques such as the Voyant tool, to compare with the codes and outputs generated through ATLAS.ti. I uploaded quotations from all the interviews, the focus group discussion and the mind mobilisation workshops generated from ATLAS.ti into Voyant, which generated trends from the quotes based on the frequency of terms from the data. I further analysed the context in which the Voyant codes were generated to understand the emerging narrative told by the collective quotes.

In addition to using triangulation techniques during the data analysis process, employ a comparative approach to validate the study's findings by contrasting the perspectives of different experts, insights gathered from community workshops, and survey findings. The household survey findings were triangulated by asking the research participants to review and provide feedback on the survey results. The research participants who reviewed the survey findings did not participate in the survey. The participants also played a peer review role on what I recorded from the 51 respondents in the survey. I also used a seasonal calendar activity to understand the community's day-

to-day activities and seasonal variations. Furthermore, I surveyed as a preliminary step, and the survey tool is available for other researchers to use. I have established a chain of evidence in a case study database and have documented the case study protocol, which is available for review. The case study database and protocol ensure the reliability and replicability of the study by other researchers in the same location and context of the MTA.

While I have employed these methods to enhance the study's credibility, Reviere (2001) argues that when conducting an Afrocentric inquiry, the researcher must assess the data against the Afrocentric principles of ukweli, uhaki, utulivu, ujamaa, and kujitoa. In addition, the researcher must depend on two other sources for useful data and for guidance in the interpretation of the data. First, the researcher must use their own experiences that are pertinent to the subject of the inquiry, and second, they must consult with the wider community for guidance in the interpretation of data (Reviere, 2001). Therefore, in the context of this study, the credibility and trustworthiness of the findings were strengthened through a combination of rigorous data collection, analysis methods, and active community involvement, ensuring the results are both reliable and contextually relevant.

3.4.2 Ethical considerations

Specific ethical considerations arise for all research involving human beings who participate in the research (Yin, 2014). Thus, approval is necessary for studies involving human beings to ensure ethical conduct during the research. The requirements for ethical considerations include informed consent, protecting privacy and confidentiality, and protecting vulnerable groups and participants from harm and the use of deception (Yin, 2014). The University of Witwatersrand Human Research Ethics Committee (Non-medical) issued the ethical clearance certificate for this study in April 2020, categorising it as a low-risk level study, with protocol number H20/02/50 (see Appendix N). The ethics committee also permitted Joey Wa Rabapane and Manthole Mashala to support the researcher as assistant data collectors for the household survey. Moreover, the late Chief Khuduhane Mamaila permitted me to conduct research in the MTA (see Appendix O). I conducted the research in a tribal land where I followed protocols, including announcing my presence in the village and purpose for visiting every time I interacted with the research participants. The protocols meant that I had to inform the Mamaila Tribal Council throughout the data collection process about my presence in the village, despite having permission from Chief Khuduhane. Consequently, the Tribal Council became the venue and location for the research interactions and engagements with the research participants.

During the interviews, the focus group discussion, and the community workshops I explained the purpose of my research to the participants and informed them that they had the option to withdraw from the interview, focus group discussion or workshop at any time, with the opportunity to contact the Wits ethics office if they had any concerns about the research process (see Appendix P). The respondents in the household survey gave verbal consent using the Ona.io data collection software (see Appendix Q and R). Since the expert interviews were conducted via Zoom, I asked the respondents to submit online consent forms which they could either complete and sign (see Appendix or submit electronically through Google Forms. I also obtained permission from the participants to record the interviews, and no one objected to using Zoom. Participants in the focus group discussion and the mind mobilisation and digital solution testing workshop provided written consent (see Appendix S). The data collection for face-to-

face and community workshops occurred during the COVID-19 lockdown adjusted levels, specifically in October 2020, April 2021, and September 2021. During these sessions, I followed strict COVID-19 protocols, ensuring social distancing, sanitising, mask-wearing, and fewer workshop participants. The workshops took place at the MTA community hall, which adhered to the COVID-19 seating requirements of 1.6 metres. The household data collectors wore masks, carried sanitiser, and completed the electronic questionnaire on behalf of the respondents.

3.5 Limitations of the study

The data collection process, specifically the preliminary household survey encountered several limitations, primarily as a result of the COVID-19 pandemic and the subsequent lockdowns. The initial perception of the survey as a government initiative raised scepticism among community members, who expected to be compensated with food parcels for their participation. Their scepticism and the long questionnaire contributed to a low response rate, with only 15.64 per cent of the intended households participating. This led to a reduced sample size and challenges in generalising the survey findings to the broader community. To enhance the credibility of the findings, the survey results were reviewed and validated by community members who participated in the mind mobilisation workshops. Moreover, the mixed-method approach resulted in the convergence of evidence demonstrated by the corroboration of views from the focus group discussion, the household survey, and the community workshops. The limitations did not affect the validity of the findings, particularly regarding the understanding of the MTA cultural framework (ways of being, knowing, doing, and leading). The majority of survey respondents have lived in the area their whole lives, thereby offering comprehensive insights into the cultural practices and processes in the area, representing perspectives spanning over 61 years across multiple generations.

Additionally, the data collection process during the prototype testing workshop encountered issues related to the technological literacy of Maola executive committee members and their lack of access to smartphones. I mitigated the limitation by relying on younger (millennial generation) participants to demonstrate the app. Given the limitations, the findings from the survey must be interpreted in conjunction with insights from the focus group discussion, community interviews, the seasonal calendar, and the community workshops.

3.6 Chapter summary

I applied a mixed method case study through social constructivism Afrocentric methods of enquiry and multiple data sources to collect data, specifically a household survey, a focus group discussion, interviews, mind mobilisation and solutions testing workshops, and observations. I also employed a household survey as a preliminary tool rather than a primary data collection method to assess the status quo status of the action-research environment before designing the action-research activities.

In the chapters that follow, I present the micro level findings from the cultural preservation, the Leola funeral scheme (fintech), and agri-tech case studies, meso, and macro level perspectives.

CHAPTER 4 ：MICRO LEVEL E PERSPECTIVES: THE CASE STUDY OF CULTURAL PRESERVATION (E-HERITAGE PROTOTYPE)

4.1 Introduction

In this chapter, I present the micro-level perspectives explored through the cultural preservation case study and the Bohwa bja rena prototype website. The chapter is organised according to the research analytical framework, starting with the cultural practices and processes dimension, followed by inclusive digital usage and adoption, digital skills, digital infrastructure, and digital leadership. I start by presenting the cultural framework of the MTA, and its intersection with technology and culture as the foundation for the Bohwa bja rena prototype website. I coded the focus group discussion respondents' identities as FGDP1 to FGDP7 and the mind mobilisation workshop participants were coded MBWP. I present the selected views of the respondents first in Selobedu,[12] to honour and preserve the essence of their linguistic heritage. I then provide a translated version, specifically for the cultural practices and processes dimension, to ensure broader accessibility and understanding of the insights shared.

4.2 The MTA cultural framework and identity

4.2.1 Cultural practices and processes

The survey findings indicate that respondents are aware of the cultural practices, although not everyone practises or observes them. Figure 4.1 illustrates the gap between the awareness and practice of cultural practices in the MTA. The community observes practices such as Aretsebaneng (family gatherings), Motshelo (local tax), Leola (funeral scheme), Khopa (initiation for girls), and Lebele (crowd-based grocery exchanges to support funerals). For instance, 41 respondents reported being aware of Aretsebaneng, with 31 individuals participating in the practices. Similarly, the respondents reported a higher awareness and practice of Motshelo, a local tax, and Leola, a funeral scheme, with 37 respondents actively participating in Motshelo and 34 respondents participating in Leola. Furthermore, the survey results indicate that there is a lower awareness of the Letšema and its practice.

The survey findings indicate that a small number of respondents were aware of Letšema, and the practice was also limited, with only a small proportion actively engaging in it. However, the respondents reported that they are aware of community practices that depend on collective action, specifically Mohodisano (stokvel) and Maphutha (crowd-based household assets funding), as some of the main economic activities. The focus group discussion respondents highlighted that women in the community rely on the collective contribution (stokvel) to help each other buy household assets and items. Furthermore, the focus group discussion respondents indicated that digitalisation could benefit community processes that involve moving money from one place to another (collecting money or making payments for Maola and stokvels). According to the focus group discussion respondents, technology could mitigate the risk of carrying cash from one place to another and could reduce the cost of sending messages.

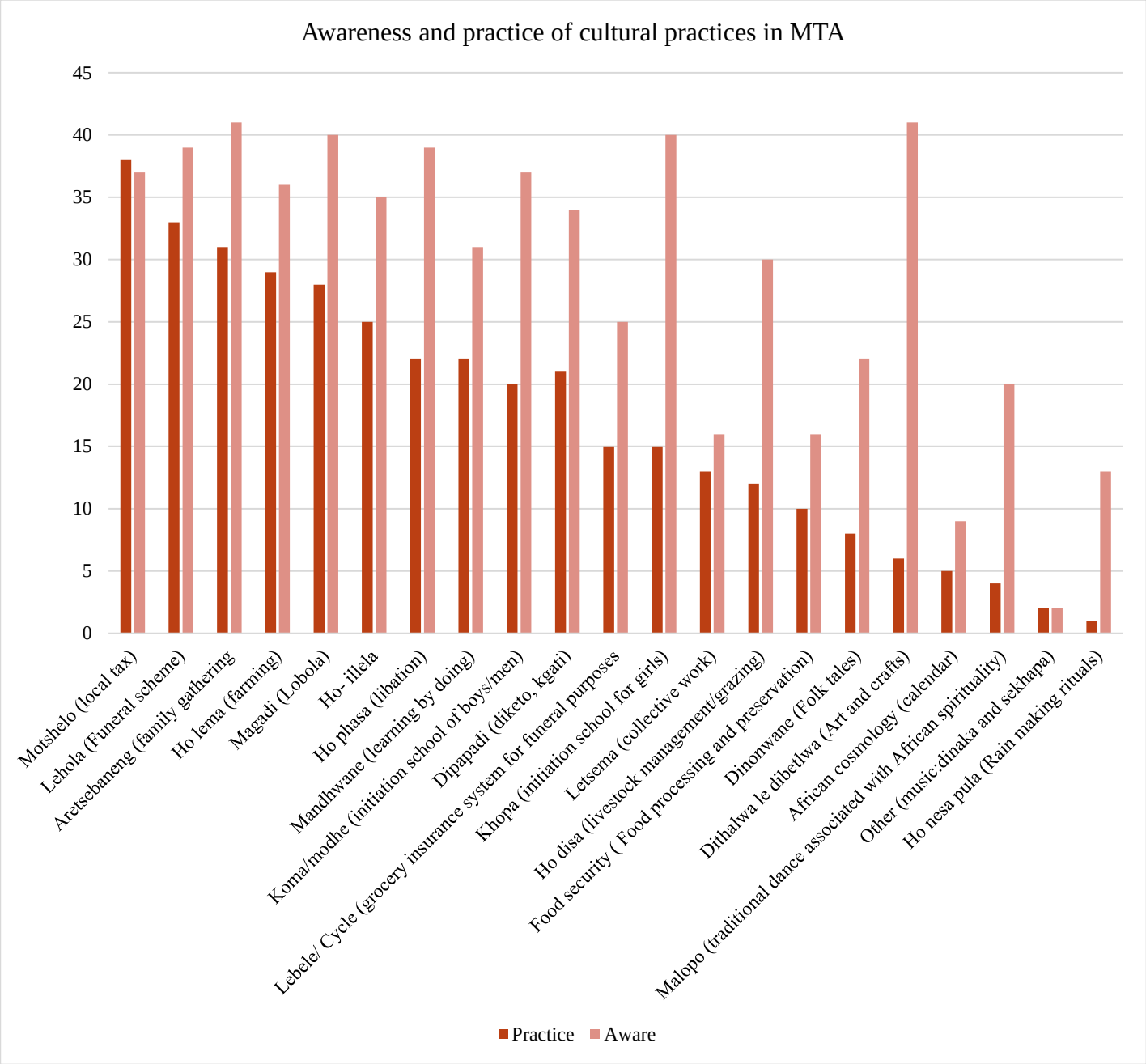
FGDP5 pointed out that while the community raises money through the Leola funeral scheme, Leola can achieve

[12] A variation of the KheLobedu language. Selobedu is spoken in the MTA due to the geographic location of the area.

more than covering the cost of funerals. He attributed the status quo to the mindset:

> So, as it stands, it means we prioritise death more than life. Because if a child is stuck or needs support, even if it is something we want to achieve, we could contribute R1.00 to raise the funds. So, this means we have limited our thinking and discussion to Leola. Even those who participate in Leola contribute money with the expectation of catering at a funeral. But they are trying to reengineer Leola so that it does not only focus on funerals. So that could also be used to develop other things.

Figure 4-1: Awareness and practice of cultural practices in the MTA



Note: This figure illustrates the awareness and practice of various cultural practices in the surveyed community. The red line represents practice, while the maroon line represents the level of awareness at the household level.

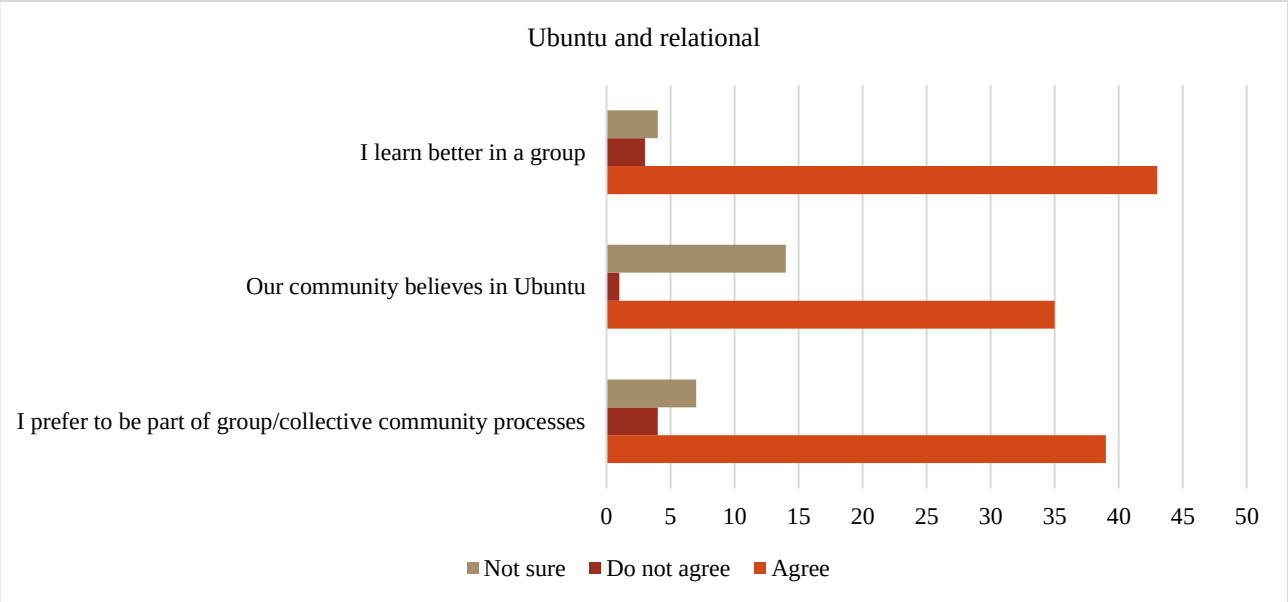
Figure 4.2 illustrates that most survey respondents reported that the community believes in the values of Botho and

learns better in a group setting. Additionally, 39 respondents reported that they prefer to participate in group or collective community processes. The focus group discussion indicated that although the values of collectivism govern the community, this value has recently been diminishing as people do not apply it holistically. However, it is still prevalent in crowdfunding communal processes such as Leola and resource mobilisation. The discussion about collectivism also revealed that although the community willingly supports each other, processes such as Maola force people to work together. FGDP4 indicated that people now operate as individuals, while in the past, people intentionally supported one another because they depended on each other for survival:

> Khale ho be ho phelwa ka Letšema. Tefo ya gona e be e ka no ba letswai ho tshwana le mo re ileho ra ya ho thusa ho buna mabele le rakholo kgaetsedi ya koko. Tshomisana e be e le ye kholo ya botho. He ele sebjalebjale se bolaile botho. Bana ba ha na bjale ha ba dumedise, baahisane a ba boledisane edioba ha mmadiatsao. Letšema ba re ke bopantiti ho ba ho somisiwa bosaedi (abuse).
>
> (The old people relied on Letšema. My grandmother's brother used to plough and harvest mealie. He used to collect us in a truck on weekends to work the land. They rewarded us with salt. In modern days, children do not greet the elders. In some cases, neighbours are not on talking terms. People perceive practices such as Matšema (collective work) as exploitative.)

FGDP6 was of the view that, in the MTA, people demonstrate solidarity when members of the community face adversity.

Figure 4-2: Preference for group or collective community processes, Botho, and learning style



Note: This figure illustrates the interplay between the individual's preference for participating in group or collective community processes, the community's adherence to the principle of Botho, and the individual's learning preference for group-based settings.

When asked if the tribal authority has rules for the community, the focus group discussion respondents highlighted that the community has by-laws to manage the graveyard to ensure the efficiency of the communal burial processes, as captured in this dialogue:

FGDP1: Ba Mosata ba na le melao ya ho tshwana le Leola. (They have rules such as Maola.)

FGDP4: Leola ke karalo ya meloa? (Is Maola part of the rules?)

FGDP1 and FGDP3: Ee. (Yes.)

FGDP4: Re diya bjane ka Batho ba se be ho maloko a Maola? (But what about the fact that not everyone participates in Maola?)

FGDP1: Ke bothata. Mo ha-Mamaila ho na le kotlo yeo e latelwaho. (It is a problem. However, with us here at Mamaila, you must pay for graveyard usage if you do not participate in the Leola funeral scheme.)

FGDP4: Mara Batho ba ho se tsene Leola ba khona ho boloka bahu ba bona mabitleng. (But people who do not participate still use the graveyard to bury or to be buried.)

FGDP1: O lefa tshelete ho tsena ka dirapeng le ho lefa baepi ba lebitla yeo ke kwano ya go kwa ka mosata. (Even Diphiri (hyenas (gravediggers)) of Mamaila, you must pay them if you do not participate in the Leola funeral scheme. This is how we know it.)

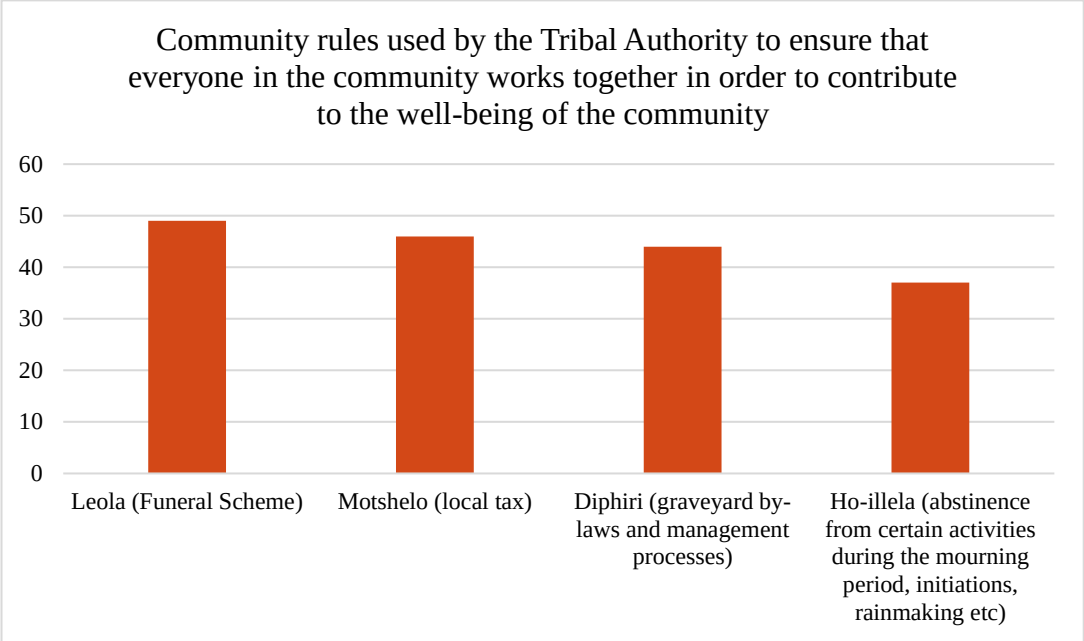
The following statement by FGDP5 highlights some challenges associated with the Leola funeral scheme and its potential benefits:

Sekhimi se sa Leola se lebetsi kudu taba ya polokano. Ka khopolo yaka re le setshaba re ka fihle lela dilo tse dintsi ka lenaneo le la leola o tshwna le o khoboketsa ditseno tsa go thusa Bana ba bahloki bjalo ka pasari (bursary) go tlhabolla naha ka tsa maphelo e seho ho lebelela lehu fela.

(I think there are nuances embedded in the Leola funeral scheme (the Leola funeral scheme is a village funeral scheme), or there is an essence in this issue of the Leola funeral scheme based on the point that you are raising, which also shows something about our mindset because we focused on the Leola funeral scheme as being about funerals even though it looks like we can use the Leola funeral scheme to achieve more. So, as it stands, it means we prioritise death more than life. If there is a case of a child who is stuck or requires support, or even if it is something we want to achieve, we could contribute R1.00 to raise funds. So, this means we have limited our thinking and discussion to the Leola funeral scheme. But I think some people are trying to re-engineer the Leola funeral scheme so that it does not only focus on funerals. So that could also be used to develop other things.)

The survey respondents reported that the tribal authority primarily uses Leola as a practice to promote community well-being through collective participation, as shown in Figure 4.3.

Figure 4-3: Community rules/by-laws used by the tribal authority, as reported by the survey respondents



Note: This figure captures examples of some of the community rules or by-laws that the tribal authority uses, including Leola Motshelo, graveyard by-laws, and Ho-illela.

FGDP3 shared similar perspectives on the role of Leola in the community, indicating that Leola is a compulsory community practice.

Matšatši aa, ke lemogile gore ge lapa le sa tšee karolo mo Leoleng, go ba boima ho tsena mabitleng a Mamaila. Ka gore ge o sa tšee karolo Leola, go ra gore ga o modudi wa Mamaila. Ka tsela ye ngwe, Leola ke kgapeletšo ka hore ge o se leloko o tshwanelwa ke ho patela Diphiri. Ka gona, go ba wa motho ke kgapeletšo e bile go bohlokwa go dira gore go be bonolo go diriša lebitla. Leola ke molao wa rena.

(Recently, I have observed that if a family does not participate in Leola, it becomes difficult to enter the Mamaila graveyard. Because if you do not participate in Leola, you are not a resident of Mamaila. In a way, Leola is compulsory because if you do not belong to any, you will pay for utilising the graveyard. You also pay for the gravediggers known as Diphiri. So, belonging to one is compulsory and important to make it easy to utilise the graveyard. Leola is our by-law.)

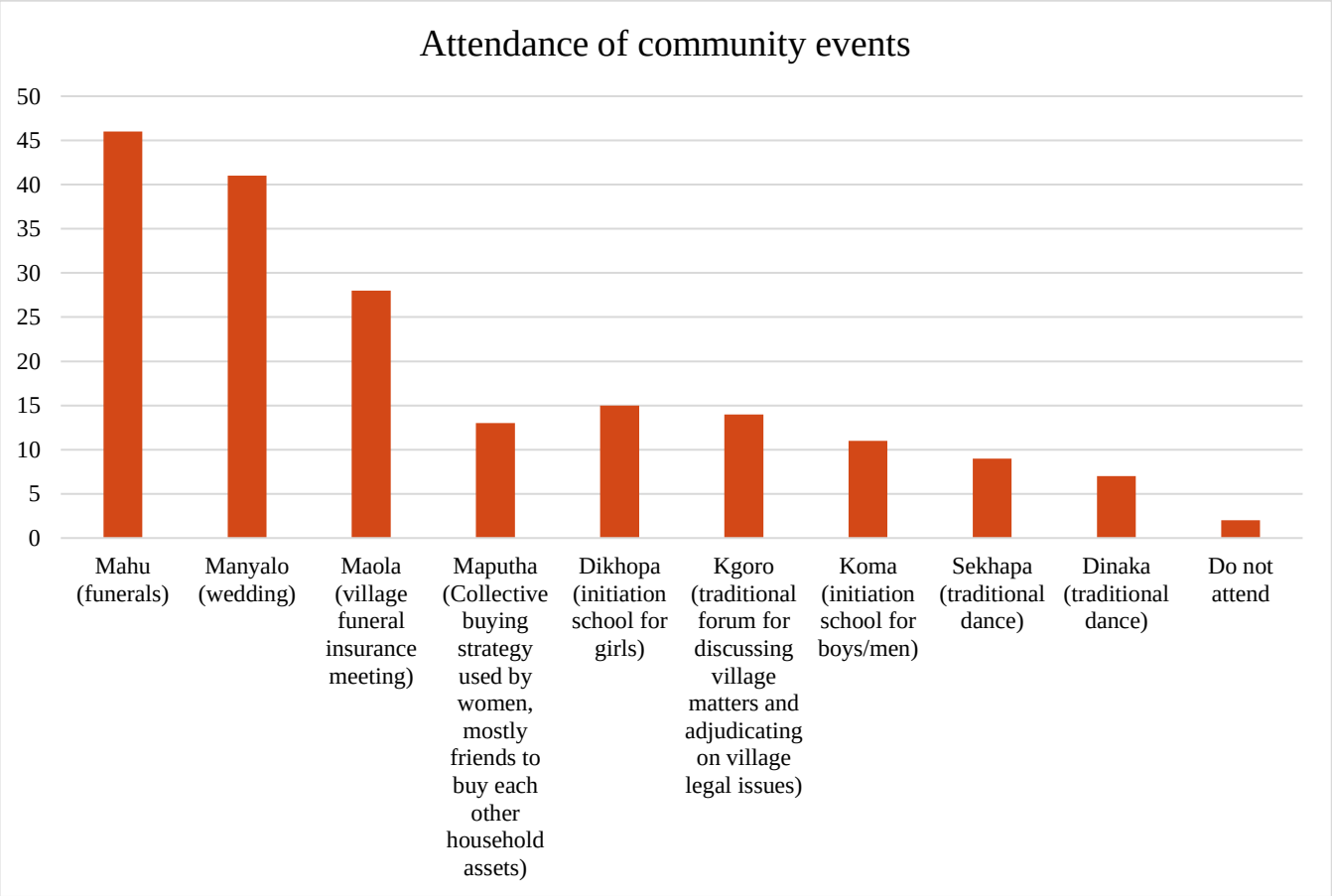
In the words of FGDP6, people in the MTA demonstrate solidarity when members of the community are facing adversity:

Le ge nka se ape ka social media. Nka apa ka dilo tšeo ke di bonago setšhabeng ge ke lekola thušo ya kopanelo ya maitapišo ao a theilwego godimo ga dinyakišišo tša ditiragalo tša Roerfontein. Go be go na le ntlo yeo e ilego ya swa menywageng ye e fetilego. Setšhaba se ile sa hlakana ba thusa lapa leo fore ba kgone go ba le lefelo la go robala. Morago bjale, go be go e-na le ntlo yeo go yona phefo e ilego ya hlahlamolla marulelo. Le mo, setšhaba se ile sa kopana gomme sa neela ka thuso ya go aga marulelo lefsa. Ka fao, seo ke se bonago ke gore go bonala bjalo ka, maemong a mantši, setšhaba se kopana ge go na le poloko gore go lahlegelwa.

(Even if I do not talk about social media. I can talk about things I see in the community when I check the collective help of efforts based on the case studies of Roerfontein. There was a house that burned in the past few years. The community came together to provide resources to help the family have a place to lay their heads. Recently, there was a house where the wind blew the roof away. Again, the community came together and donated resources to reconstruct the roof. So, what I see is that it looks like, in many cases, the community comes together if there is a funeral or a loss.)

Figure 4.4 indicates that the respondents attend community events, predominantly funerals, followed by weddings, Maola meetings, and crowd-funding events.

Figure 4-4: The attendance of community events, as reported by the survey respondents



Note: This figure illustrates the main economic sectors according to the research respondents.

During the mind mobilisation workshop, the participants created a seasonal calendar, as depicted in Figure 4.5. The seasonal calendar indicates that the community's activities are closely linked to specific seasons. The seasonal calendar highlights the agrarian nature of the MTA community, with significant engagement in agricultural activities throughout the year. Selemo (summer) is a critical period for farming activities, including ploughing, weeding, and seed preparation. Family gatherings and events such as the unveiling of tombstones also mark this period. During Lehlabula (autumn), the community participates in cultural and traditional activities such as attending Kgoro (traditional court) and church conferences, alongside preparations for the harvest season. In

Marega (winter), the community and households prepare for the circumcision of boys and girls. During Seruthwane (spring), the focus is on land preparation, crop planting, and land maintenance while observing Heritage Day celebrations. The communal seasonal activities include the preparation and attendance of events such as funerals, Maola meetings, the celebration of heritage activities (initiations), social gatherings (parties), and spiritual activities (libations and church conferences), captured in the figure below.

Figure 4-5: Mamaila seasonal calendar



Note: This figure captures the community calendar based on the activities identified by the research participants during the mind mobilisation workshop on 21 April 2021. Source: Author, 2024.

The household survey, focus group discussion, and seasonal calendar suggest that farming and communal financial systems are the main drivers of the MTA's economy. FGDP5 pointed out that the community did not explore the existing communal systems in a way that could maximise their impact and solve other challenges in the community. According to the respondents, the inability to expand the existing capabilities relates to the community's mindset. Furthermore, he pointed out that the MTA community currently supports people who are not in the community, highlighting that money is leaving the community instead of circulating within:

> Money circulation within the community if we were supporting shops that our own people manage. Currently, we support people who are not within our communities. At the end of the day, the money is leaving the community. I think these diseases may require us to go back to the basics to encourage each other or ourselves to support each other. So, if we support each other and circulate our money within the village, we can be able to exchange assets or even ask each other for donations. People will not mind exchanging assets or goods because they will know that we support each other. This makes our money flow within the community, unlike people

> who come from outside.

FGDP4 pointed out that some people in the community see themselves and others as incapable and do not value their culture in building the local economy. According to FGDP4, people fail to see the link between the economy and culture due to their lack of appreciation for their culture. In the words of FGDP4, the community of Mamaila has the potential to expand its economic value:

> We see ourselves as people who are mentally incapacitated. We operate with a mindset that we cannot. We believe that we are not capable of it. For example, if you decide to open a shop, people already judge you because they doubt your capability. We see ourselves as people who lack talent. However, if a person from a different race or place opens a shop in the village, we say the shop will survive.

FGDP6 disagreed with the perspectives of FGDP3 and FGDP4, highlighting that cultural events such as the celebration of initiations contribute to the local economy to a certain extent. According to him, the economy can be two-fold at an individual level, focusing on how individuals can generate money to survive. For example, ceremonies like male initiations require traditional beer. Some people do not brew traditional beer at home but buy from others, which means that a person who sells Mtomobothi (African beer) can earn income from the sale:

> Again, we have weddings on Saturdays and Sundays, which require traditional attire. It means that those who make traditional clothing can generate income during the wedding season. This is the kind of economy that I am talking about. And then at Roerfontein, we have people who sell mala and mogodu. However, other people want modern food. This means that we do not value our things because of our mindset. We prefer other people's things. We promote other people's things and devalue our own.

Sometimes, "it depends on who introduced the practice". He said:

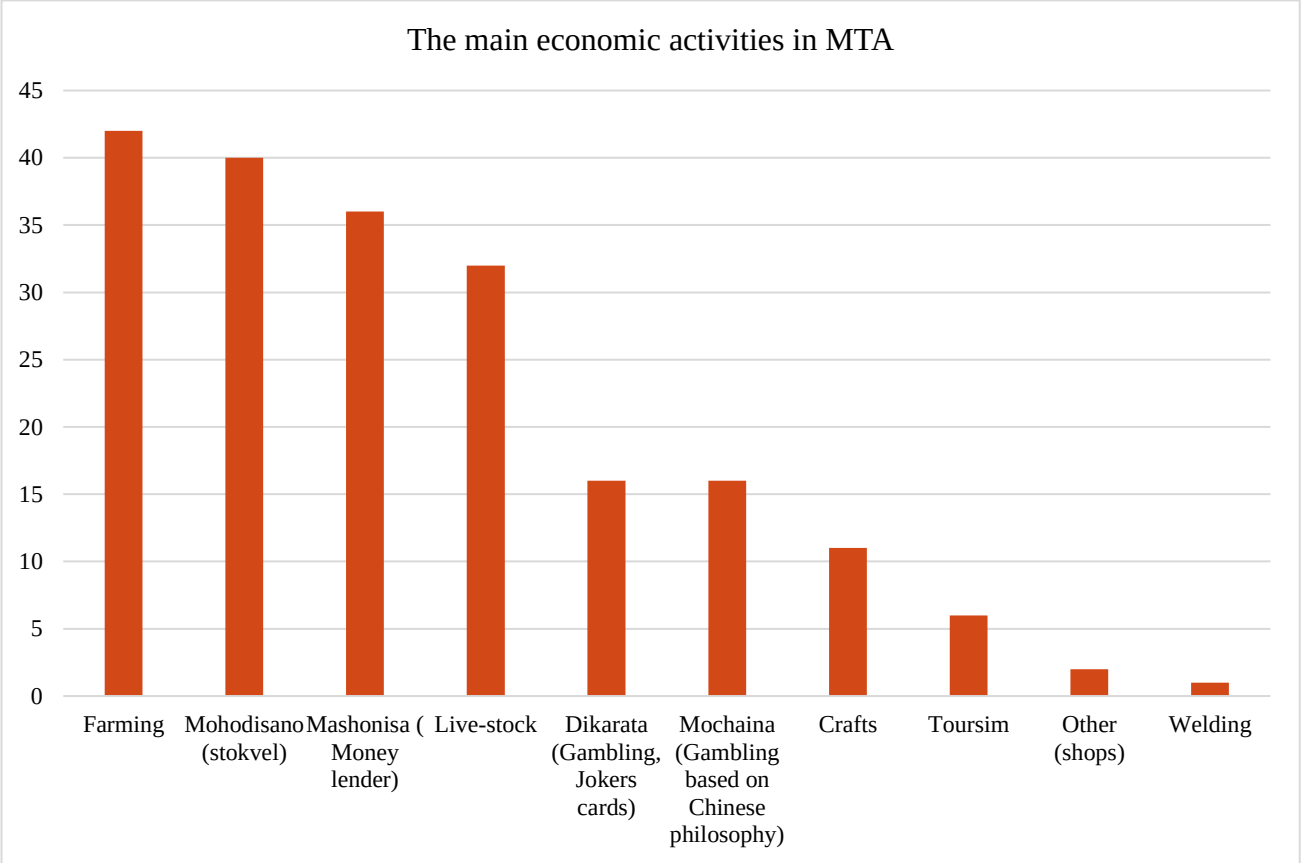
> If someone from outside comes here to sell Makeke (termites), we will buy, but if I sell, people will not buy. For example, when it comes to spaza shops, people buy from Pakistanis, but if our own can start the same things, we do not support them. So, the problem is that we do not support each other. We do not value our things. If someone decides to eat Mashontja (Mopani worms), we say they are struggling or backwards.

FGDP5 shared that, in some cases, people who grow vegetables or make crafts sell their products to big shops in town. These shops purchase the products at a lower price from local producers and then resell them at a higher price to generate profit for themselves:

> It is like we are no longer capable of doing things on our own, like farming, pottery, and crafts, and using them to generate income. Recently, we have seen our crafters of things like wooden spoons taking their products to retailers and wholesalers such as Primjee, and then we go to buy the same things at Primjee instead of buying directly from our local crafters.

The focus group discussion data reveals that community leaders do not believe that culture contributes to the local economy. In contrast, survey respondents indicated that cultural practices and processes contribute to the local economy and income generation, as depicted in Figure 4.6

Figure 4-6: Main economic activities in the MTA



Note: This figure illustrates the breakdown of the primary economic activities in the village, as reported by respondents, illustrating that farming, stokvels (Mohodisano), and money lending (Mashonisa) are the most frequently mentioned economic activities.

The focus group discussion participants highlighted that totems constitute a fundamental part of the community identity. Furthermore, in the past, people gave their children ancestral names that connected the present to the past. According to the respondents, the older generation addresses children with their totems more frequently, compared to modern parents. The participants noted that although people are aware of their totems, there is a loss of cultural heritage memory because households no longer follow practices such as addressing children using totems and naming children, as was done in the past. The quote below indicates that the totems and names served various purposes.

> Ka haesu, ge re be re sa le ba banyenyane, bo koko ba be ba re reta ka Moano wa rena. Ba be ba re reta ge ba nyaka o re khothatja le ho re hlohloletša. Kudu-kudu he rediele selo seo se ba thakatjaho. Batswadi ba matšatšia a ba o tshwana le nna re bitša bana ba rena ka dilo tše tja ho tshwana le bo “My girl” edha mo. (FGDP3)
>
> (At my house, when we were still young, my grandmother addressed us with our totems. She normally used this to encourage and motivate us, especially if we did something that made her happy. Modern parents like me address our children with things like “my girl” come here.)

FGDP4 added that, in the past, people gave children names that belonged to their ancestors for various reasons:

> Another thing is that back then, the old people gave us names that were linked or belonged to the dead or ancestors. When they addressed you, they were addressing the departed, and they knew that you were carrying a big name. In modern day, we do not give children those names because of the transformation.

FGDP1 also highlighted that, from generation to generation, there is a loss of cultural memory. She highlighted that the generation before hers knew that culture was vital: "Like with our generation,[13] we grew up when our culture was already at risk of being lost. It means our children and the next generation will not even know about their totems."

FGDP1 emphasised that cultural practices are essential; however, if her generation wants to transfer them to their children, the latter might not embrace or even understand such practices because they grew up without cultural exposure because of the 4IR.

> Ke mokgwa woo re reho re mo ho 4IR ka he re bona phetoho ye ntši. Bana ba rena ha ba tsebe ho re ho be ho dieya ene mengwaga ya ho podha ho fihla naase. Dilo tse di die yago zwazweno zwe fapana le zwa mabaka a kgale. Bana ba bo rena ha ba tsebe setšo sa rena. Re lahlile mekgwa ya Rena ya setso le bokhoni ka hopola ho re a di na mohola. Re hlakaneditse phetoho ya ho fapana le setšo sa rena.
>
> (That is why now we say we are in 4IR because much change happened. Our children do not know what was happening in the past until now. Things happening today are different from what used to happen in the past. We also do not teach our children. We do not know our culture since we have lost it. We dropped our cultural practices and knowledge because we thought they were no longer important or relevant. We adopted a different revolution.)

Another factor that emerged from the respondents is the role of language. FGDP2 pointed out that language is part of identity, and, in the past, the older generation used greetings for multiple purposes. Recent societal changes have led to some people abandoning the traditional ways of greeting:

> Setšhaba sa rena se bseletswe ke mekgwa ya Rakholokhukhu ya tumedisano yeo e bego e khumile ka botho bja setšo (ho dumedisa ka sereto). Ha bjale ka ba ka la phetoho ya bophelo Bana ba rena ga ba dumedise ge are o ho dumedisitse ke he ho khabola polelo ya sejahlapi (good morning).
>
> (As nations, we are changing. We even lost our way of greetings. The way our grandparents used to address us was also embedded in our greetings. However, now, this is changing because of the day-to-day transformation. Kids do not greet us the way we used to. They know "good morning".)

FGDP1 commented that, in modern-day society, children lack knowledge of their culture, apart from practices like dikhopa (initiation for girls). The children do not know what people used to wear as part of their culture and traditions, in contrast to her generation, which had the opportunity to observe some of these practices. She pointed out that Chinese people do not lose their culture. Children in the MTA should be able to know and write about their

[13] Generation X.

culture. According to FGDP1, the transition to democracy contributed to the cultural loss:

> Ke nagana ho re go tloga ka 1994 ka morago ga dikheto le go khumana tokologo, re tšiele tokologo ka mokgwa wa go se dhwesise. Ga se ra, dhwesisa go re re tshwanetše go tšea karolo efe ka go tokologo ye. Tokologo ya rena e dirile go re re lahle dilo tsa rena tse botse gomme re di tloge tse matsogong a Batho Bashele ha bjatse re palelwa ke go hlokomela le go boloka setšo le polelo ya rena. 1994 e tsentše tse dintši.
>
> (I think from 1994; after voting and getting freedom, we took freedom in a way that we did not understand. We did not understand our role in democracy. We became free in that we have let go of many things and left them in the hands of Bashele (foreigners) in a way that we are failing to control or manage our culture. So, things got messed up after 1994.)

Furthermore, the focus group discussion respondents stated that society is constantly changing, requiring communities such as Mamaila to adapt to the disruptions without losing their identity and heritage. In the words of FGDP2:

> Ditšhaba tse dingwe he di e tla le ditso tsa bona ho rena, re nagana ho re ba a re tlhabolla kganthe ha se zwona. Bathobaso re lahlile setšo le mekgwa ya se hahaborena bjaka dijo.
>
> (When other people introduce things to us, we assume that we are developing as black people, but we are not. Because these things come from other nations, they are inventing them and giving them to us, and we think we are developing, but we are moving away from our culture. We think we are progressing because we did not previously have those things. We are moving away from our culture and traditions.)

Moreover, people in the community associate the cultural food system with poverty, as FGDP1 stated:

> He ba khumana o e dja boswa ka mokhuse, makeke hoba dithaka tsa marotse, ba nahana ho re o a diila ho ba a o na tshelete. Seo se bontšha ho hobala ha monahano.
>
> (If you eat pap with dried Morogo (vegetables), people think you are poor. If you make pumpkin porridge, people look shocked and comment negatively, assuming that one is financially broke. People now eat rice and spaghetti and think it is development according to them. They think their own food is inferior. So, the mindset is an issue.)

FGDP1 highlighted that even though the community has its traditional food, the children do not eat the food. For example,

> my grandchild even tells me that I do not know how to cook because they prefer samp from school because it is different from the traditional one. So, even our minds are programmed to accept the situation. We promote the thinking that our children do not eat our food. We promote that children prefer KFC over our traditional food.

In addition, FGDP1 highlighted that it is crucial to educate children about their culture when they are young so that they grow up knowing that certain things happen every day.

In contrast to FGDP2, FGDP5 emphasised that people cannot ignore modernity and remain stuck in the old ways

of doing things:

> It is impossible for us to do things using the same modes or methods because things have changed. Back then, they could decide to pound the harvested mealie until or whenever, but in modern times, we have due dates or timeframes for everything to ensure that we process things within a specific time frame. Modern life is time-bound and fast. If you spend your time writing 99 pages with a pen in this era, it will be a problem.

Furthermore, FGDP1 highlighted challenges concerning mechanisation:

> Rena le bothata ka hore a re sa zwe diyela dzwelo. Re tsepile Batho ba bangwe. Re emetši gore motho yo mongwe a dhe a re fe dilo. E bile re na le malwetši a Mashele ka lebaka la gore ga re sa lema go tsweletsa dijo tsa rena. Re lahlegetwe ke mekwa ya setso sa rena ya dijo, yeo e be e re thusa gore re be le bophelo bjo bo botse […] Se ke se sengwe sa ho boloya economy.
>
> (We have a problem because we no longer make things for ourselves. We are dependent on other people. We are only looking or waiting for someone to come and give us something. We even deal with "foreign diseases" because we no longer engage in farming activities where we can produce our food. We have lost our food system management processes, enabling us to eat healthy food [...] So, this is one of the things that kills our economy.)

FGDP1 also emphasised that the community is not able to grow economically because they do not produce things for themselves, they are largely consumers. According to her, in the past, older people produced food in bulk. They sold and shared with people experiencing poverty. While the focus group discussion respondents highlighted challenges about the loss of cultural knowledge, they also indicated that the Department of Education is actively integrating heritage into the curriculum to create opportunities for children to learn about their culture. The respondents pointed out that the school curriculum indirectly encourages parents to participate in the reclamation of cultural heritage, although there was a view that parents participate in the process to comply with the school requirements. FGDP4 pointed out that celebrating Heritage Day contributes to raising cultural awareness:

> It is also important to celebrate days like 24 September as part of our heritage because it enables people to come together for communities such as Mamaila through gatherings such as Aretsebaneng. Such platforms serve as learning spaces for children about their culture as people would take videos, while there are also dances or traditional dances. For example, at Mamaila, our 2020 Heritage Day was visible. I am not sure if it was because of COVID-19 or what. It looked like our heritage or culture was alive because I saw people dressed in their cultural attire as I moved around the village.

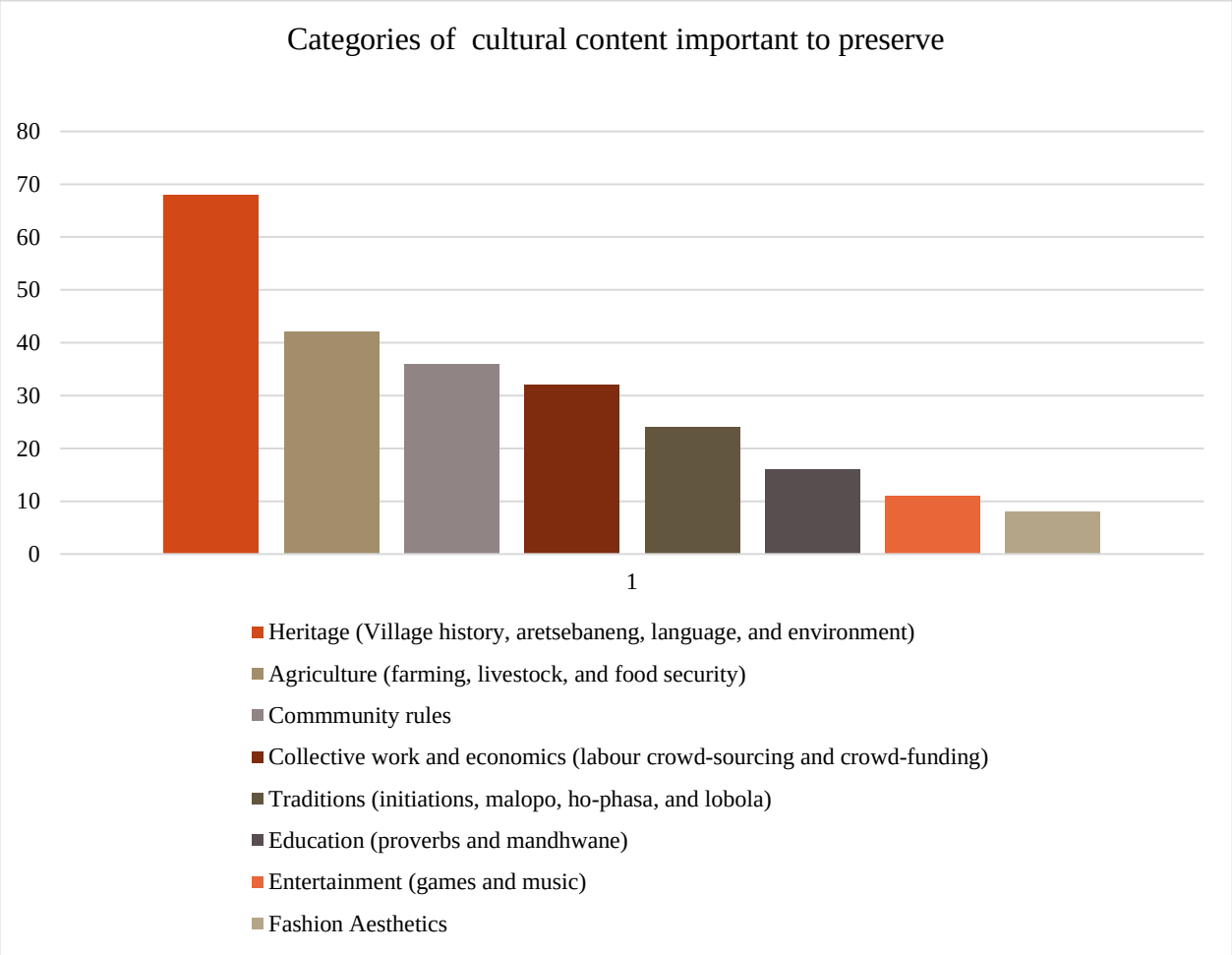
In contrast, FGDP2 pointed out that while people celebrated heritage, in his view, it was because the President encouraged communities to celebrate. He further emphasised:

> Ka go realo o na le dilo tšeo re hlokago wa go re botša le ge e le go re ruta tsona. Re tshwanetše o zwidiyela dilo. Batho ba theeletša taelo ya mopresidente ge a re dirang se go tshwana le go binela mmino wa Jerusalem. Ge a ka re se diye re ka se diye. Re le Batho re tshwane tše go dhwesisa go re ke rena bomang ge re le Balobedu ka hore re tla dula re le Balobedu.

> (There are some things no one should tell us. We must do them on our own. So, people responded to the President's call when he said they must celebrate our heritage and dance to Jerusalem. If he can say, do not do it, we will stop. We must understand who we are as Balobedu or as people and know we will always remain Balobedu. Our problem is reacting according to a situation we find ourselves in.)

On the other hand, the survey respondents highlighted that it was vital for them to preserve village history, family history (totems and praise songs), language, and the food system, as shown in Figure 4.7. Heritage content includes village history, environmental knowledge, cultural practices like Aretsebaneng (family gatherings), and language. Agriculture-related content indicates the importance of farming, livestock management, and food security to the community.

Figure 4-7: Categories of cultural content that are important to preserve



Note: This figure illustrates the type of content deemed to be important for preservation, including village history, family history entailing totems and praise songs, language, and the community's food system.

While in the field, I observed that although there is a concern about the loss of culture, there is continuity and reclamation of heritage championed by the children in Mamaila, as shown in Figure 4.8.

Figure 4-8:Khodhokhodo Sekhapa Group: Photo by Ivonne Maluleke, 2021



Note: This figure captures members of the Mamaila Kodhokodho Sekhapa music genre, established by youth in Mamaila village. The picture was taken in May 2021 by the action-research co-creators and curators of the cultural content uploaded on the Bohwa bja rena prototype.

4.3 Inclusive digital adoption and use

The section explores the intersection between culture and technology in the MTA. The survey respondents reported using technology to preserve and share their cultural content. Furthermore, the focus group discussion respondents highlighted that technology could help school children to document and store their heritage. In addition, they pointed out that technology can assist in managing community-based financial management processes. Moreover, the mind mobilisation participants shared that they were using technology to pay for electricity, search for information, and communicate with family members who work in Johannesburg. The themes that emerged from the data analysis include social capital and collective action, cultural preservation, ownership, and representation.

FGDP6 shared that he was already using technology, specifically Facebook, to distribute information, raise awareness, and mobilise support for various needs, such as providing sanitary towels for children:

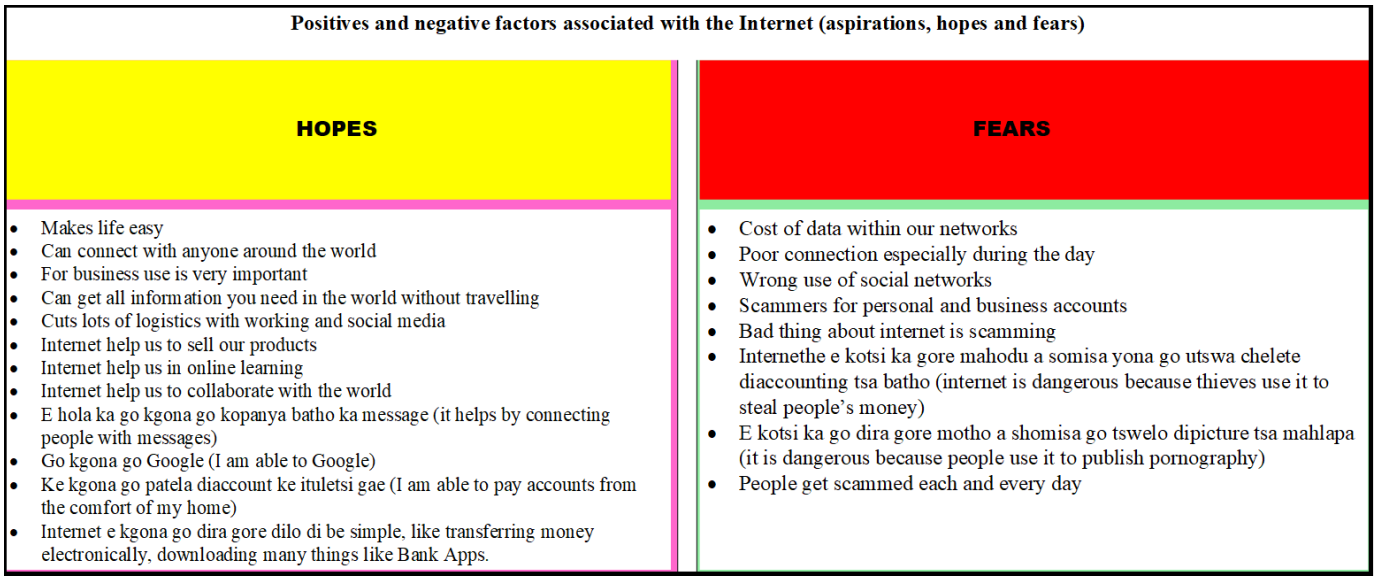
> We can use technology to support information dissemination and communication about the required contributions. So social media helps in exposing the message and quickly getting support. For example, a few days ago, I posted about a child who needed sanitary towels. Within an hour, many people pledged and contributed to helping the child.

Furthermore, FGDP4 highlighted that technology can also help the community to create updates about activities such as Maola, where people can use the same apps to pay or transfer money outside the village:

> Technology can also help us to manage our contributions and missed payments. It will also help us to inform us about meetings just like the COVID-19 app can inform us about people who have the virus and are near us. In cases where people discuss money, people can coordinate and manage the finances, which means that people can manage the process without travelling from one place to another. So, technology enables the process.

The data from the mind mobilisation workshop indicates that people use the Internet as it gives them access to information, as shown in Figure 4.9. The participants also shared their hopes (positive) and fears (negative) when they think about technology, specifically the Internet.

Figure 4-9: Aspirations and fears associated with technology



Note: This figure illustrates the aspirations and fears, the positives and the challenges of the Internet, identified by the research respondents during the mind mobilisation workshop.

The focus group discussion respondents highlighted that the community of the MTA is facing the loss of cultural heritage across the different generations. However, technology plays a role in preserving intangible and tangible cultural heritage knowledge and transferring it to the youth and future generations. The survey respondents indicated that community members already use digital technologies to create, store, and share their cultural heritage, using videos and photos. Figure 4.10 is an example of digital products produced by digital entrepreneurs in the MTA. Joey Media Group is one of the digital entrepreneurs who created videos of the graduation ceremony (Mokete wa Kopa or initiation) of Modjadji Hope Matokane from Sephukubje village.

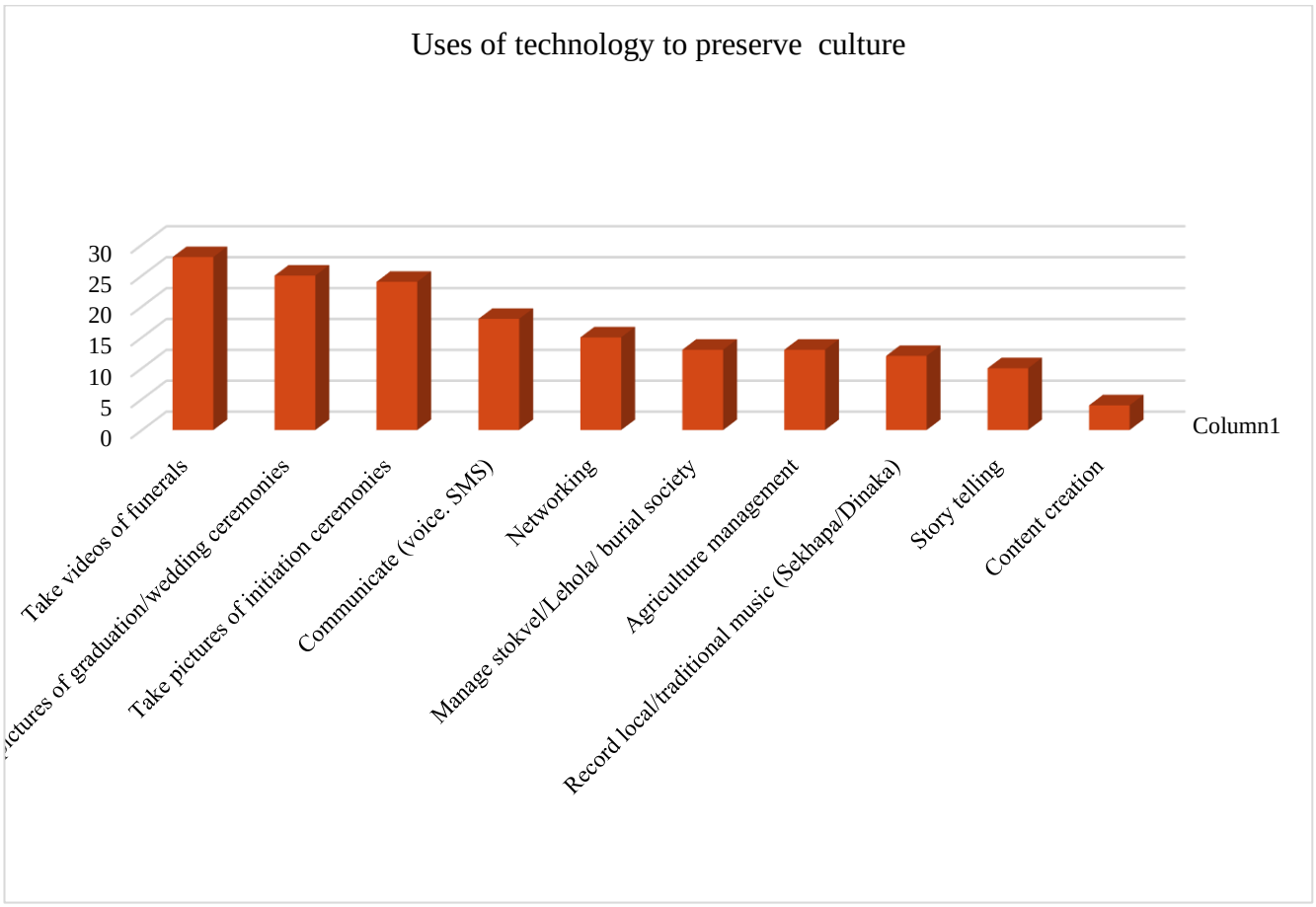
Figure 4-10: Example of digital entrepreneurship services for initiation celebration and funeral proceedings



Note: This figure illustrates an example of the digital products produced by digital entrepreneurs in the MTA.

Figure 4.11 illustrates the intersection of culture and technology in MTA.

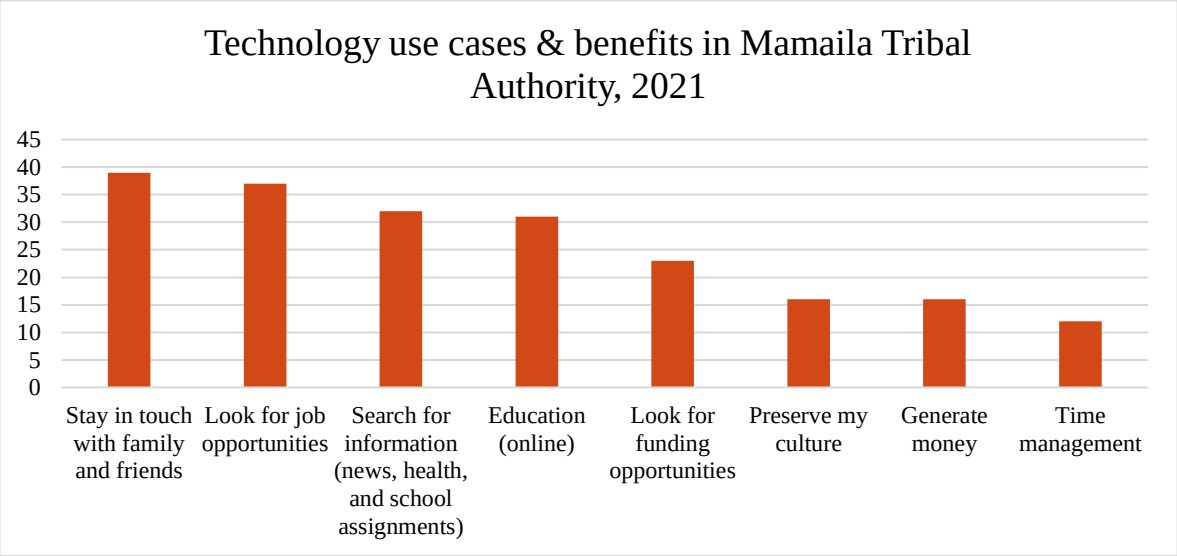
Figure 4-11: The intersection of culture and technology



Note: This figure illustrates the use of digital technologies and devices for the preservation of cultural practices and processes in households, as reported by survey respondents.

Figure 4.12 highlights the survey respondents' various reasons for using technology, including staying in touch with family and friends, searching for job opportunities, accessing information (news, health, and school assignments), pursuing online education, seeking funding opportunities, preserving cultural heritage, generating income, and improving time management.

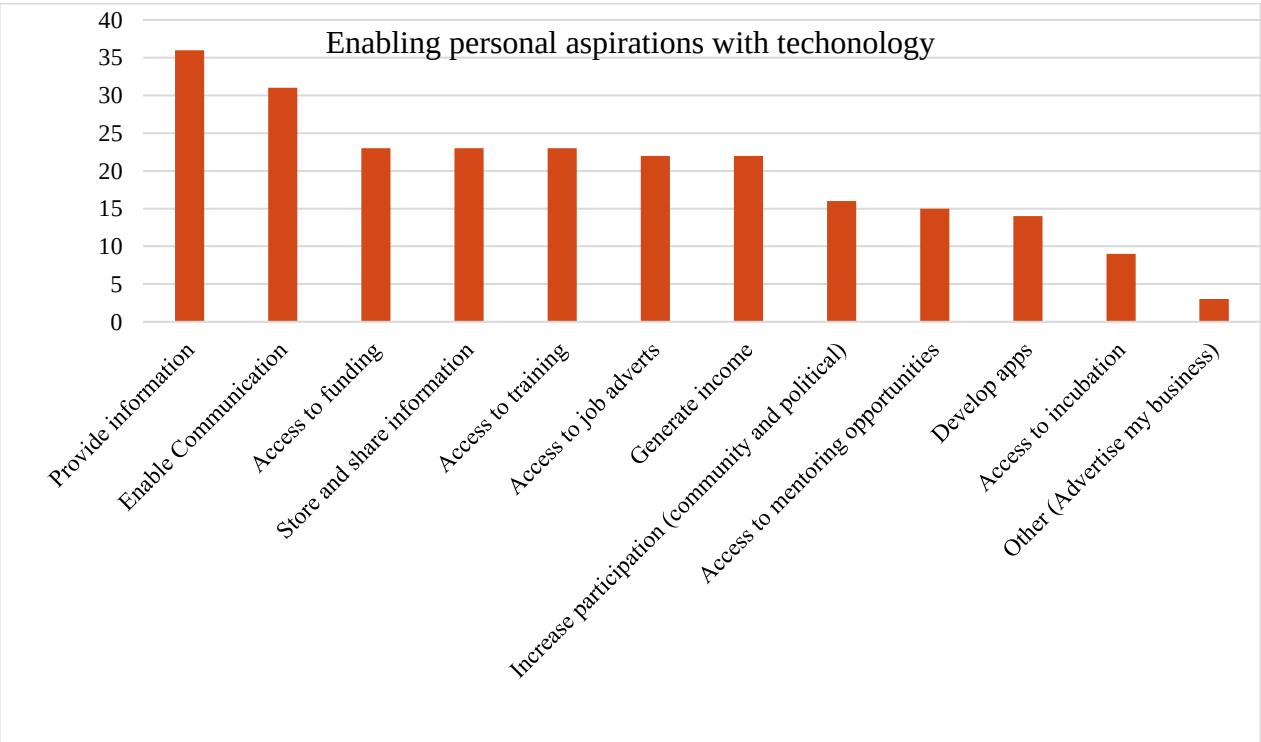
Figure 4-12: Technology use cases and benefits in the MTA



Note: This figure summarises the technology use cases reported by the survey respondents.

The graph in Figure 4.13 captures some of the aspirations expressed by the research respondents and what they perceive to be the role of technology in enabling or supporting their individual goals. The survey responses indicate that access to the Internet, money, land, education, and water are some of the things that people value and would like to obtain.

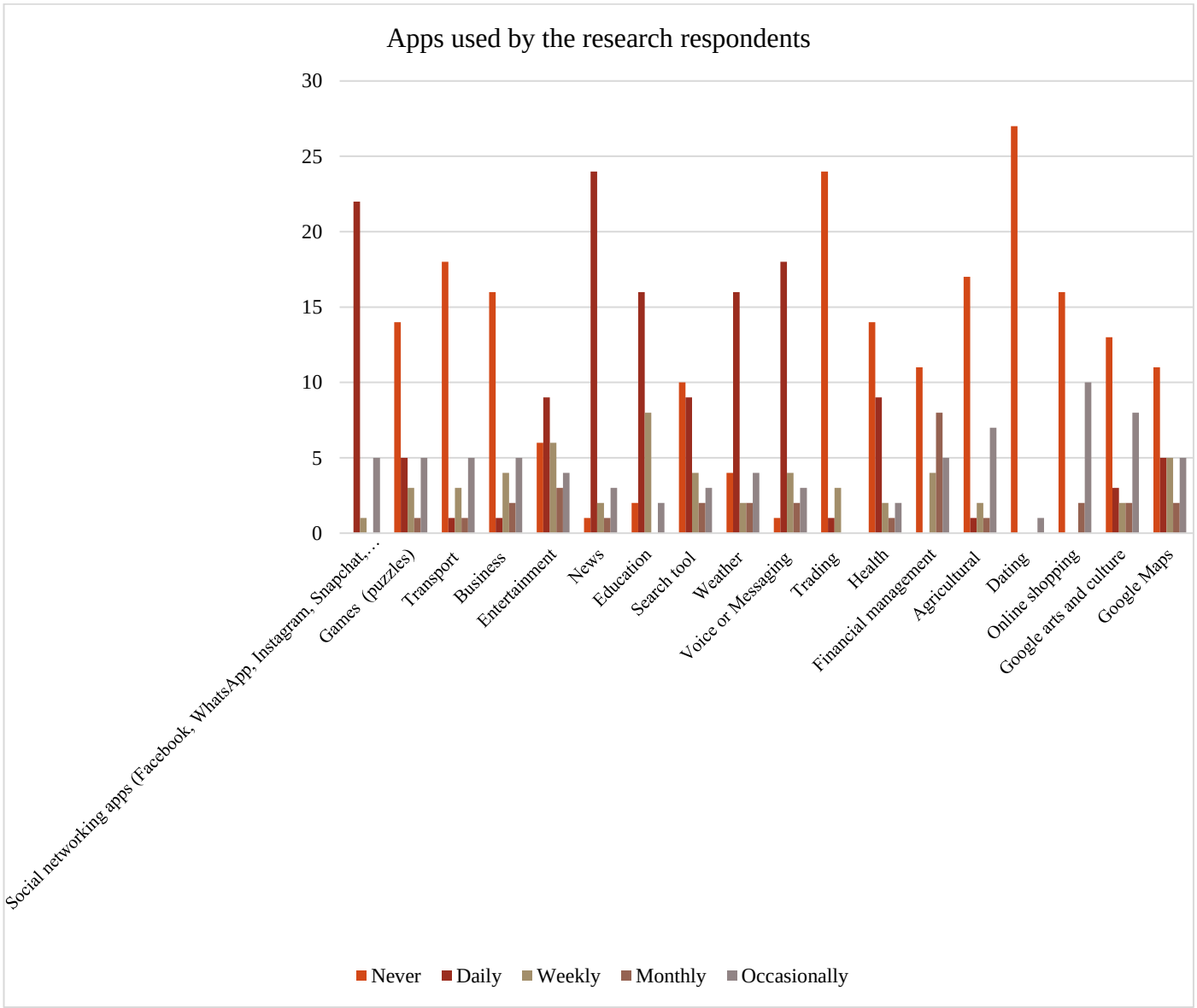
Figure 4-13: Aspirations and ways in which respondents think tech could help them to achieve their goals



Note: This figure illustrates the respondents' technology aspirations and associated benefits.

Figure 4.14 illustrates that the research respondents use social networking apps daily, which has the highest frequency of daily use, followed by news apps, voice or messaging apps, weather apps, and education apps. Regarding app use, the survey participants indicated that they use social networking apps daily (22 participants) and news apps (24 participants). Respondents reported using weather apps quite frequently, with 16 participants indicating weekly use, two participants indicating monthly use, and two participants indicating occasional use. Occasionally or never used apps include trading, dating, and online shopping apps, with respondents indicating infrequent or no use of these categories.

Figure 4-14: Mobile app use by category



Note: This figure illustrates the frequency of mobile app use across various categories, as reported by survey respondents.

4.3.3 e-Heritage experimentation: Our heritage website (Bohwa bja rena prototype website)

The focus group discussion and mind mobilisation respondents suggested various ways in which the community could use technology to preserve culture, as captured by the quotes below:

> I think if we have the technology, our children can ask their grandparents to recite praise songs and save them on the USB. Tomorrow, this might help the child to know their praise song. (FGDP1)

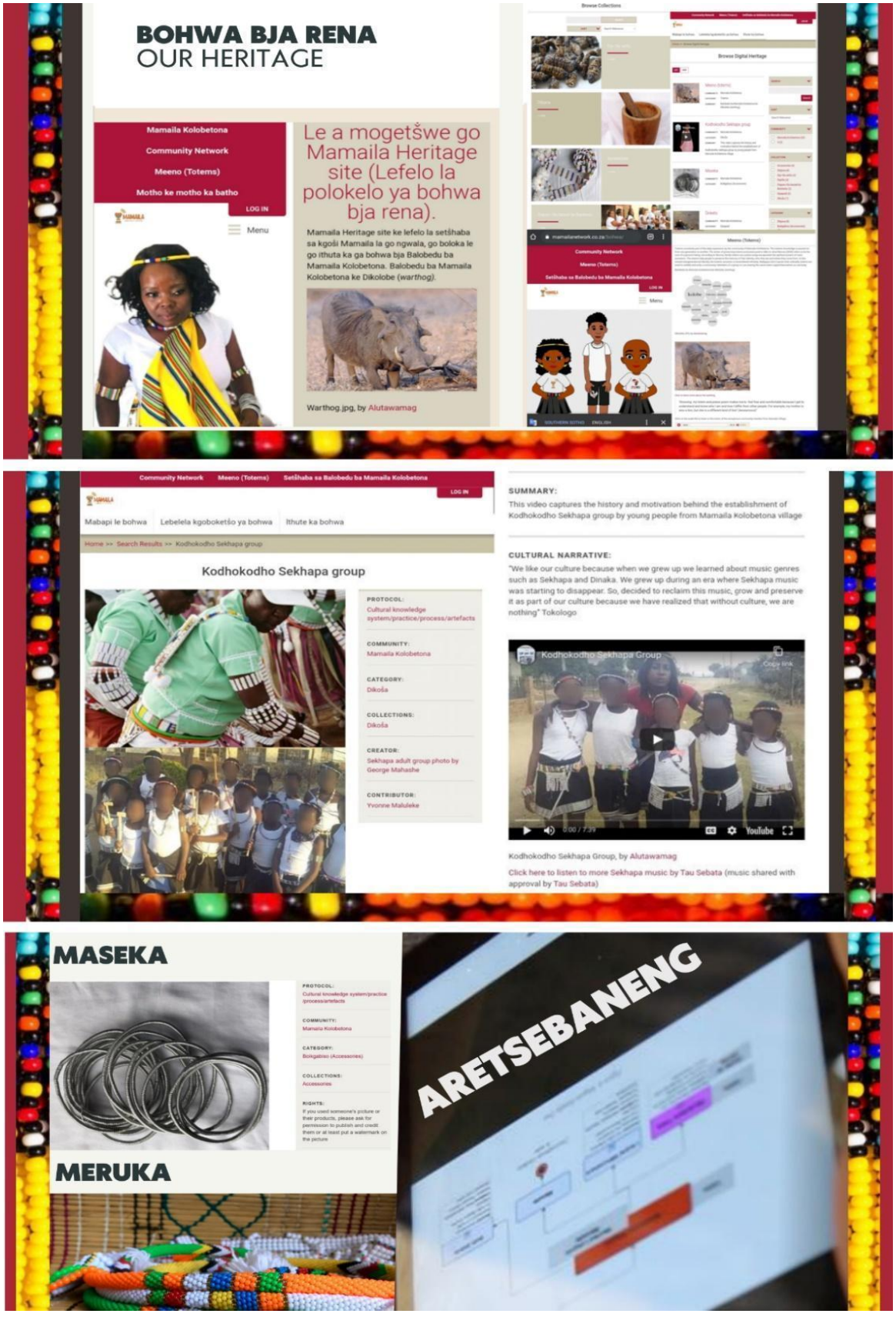
> Technology can help us preserve our culture using what is known as the archival record system, where we can store information about our past, which can help the future generation, who can access that information through the Internet. They could, for example, use that information to learn about past events. (MMWP9)

Furthermore, the respondents pointed out that using the local language is essential, as captured by FGDP4:

> Language use is a key factor. When you search the Internet for information, the content is unavailable in Sepedi. But if we can have websites that cater for our own languages, for example, I am a Pedi person, so when I go online, the content should be available in Sepedi. When it comes to creating emails, I should be able to use my totem, e.g. mbau@gmail.com. This will help me to know that I belong to the Mbau totemic clan or to help me remember my totem. Immediately when I go online to search for Mamaila, I am directed to information about the history and cultural knowledge systems of Mamaila, which also captures our totems. This will always remind people about who they are.

Twelve survey respondents stated that online platforms do not readily offer content about their cultural practices and processes. The respondents stated that they do not know whether content about their cultural practices and processes is available online. They indicated that they would use the Internet more if online content about their cultural practices, processes, and village information existed in their language. I used the input from the concerns raised by the focus group discussion respondents about the loss of cultural heritage and memory, along with the reported use of digital technologies by survey respondents to preserve, store, and share cultural heritage content, to inform the design of the prototype illustrated in Figure 4.15.

Figure 4-15: Bohwa bja rena prototype website

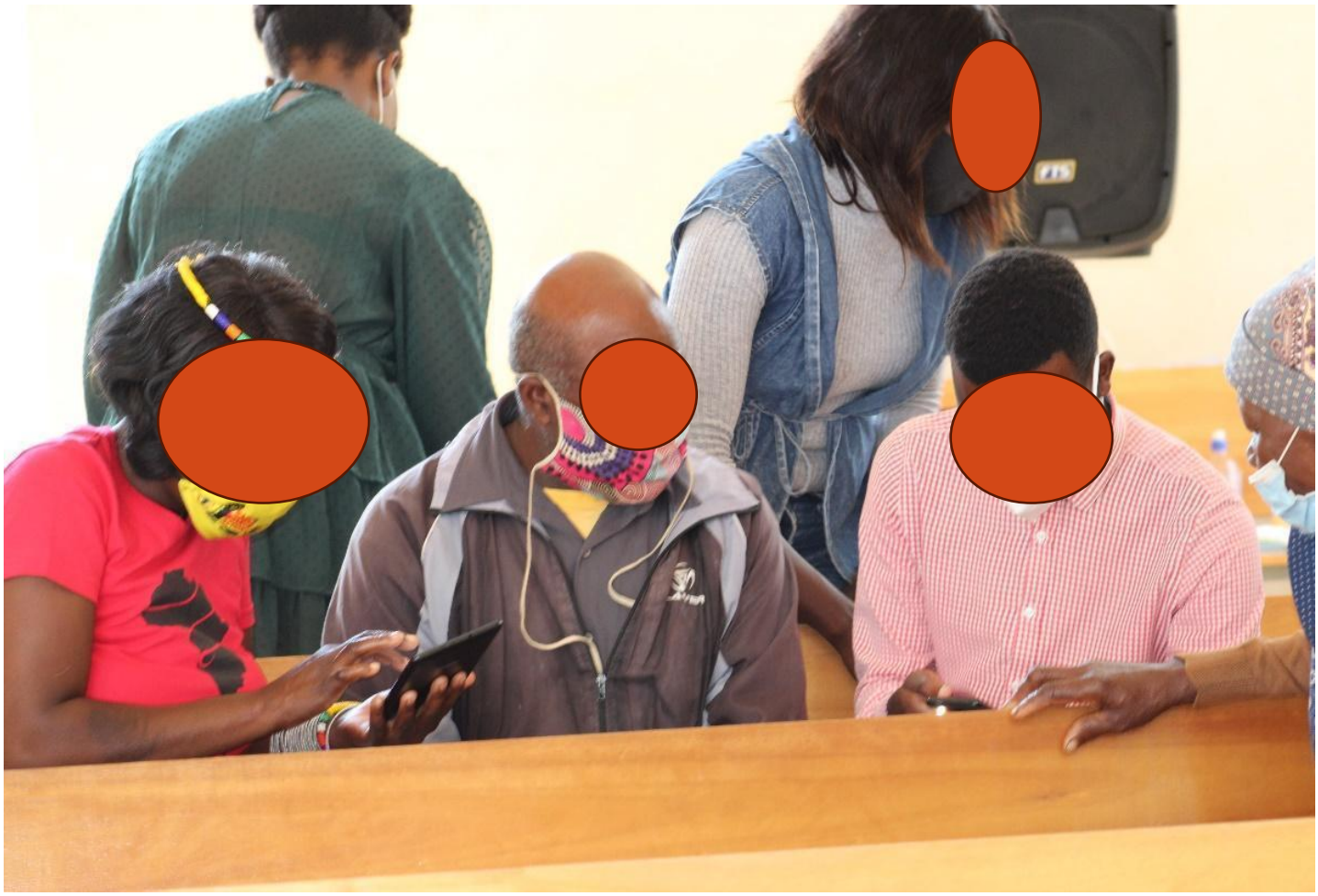


Note: This figure illustrates some of the content published on the Bohwa bja rena (Our heritage) prototype, which showcases the cultural heritage content. Source: Author, 2024.

The participants browsed the Bohwa bja rena prototype during the mind mobilisation workshop, as shown in Figure 4.16. The quotes below capture some of their feedback:

> The importance of this website is big. It looks like Google, but our own local Google helps us learn about our culture. I was browsing the page about Sekhapa and sharing with other people that, currently, the website only shows pictures of Sekhapa. So, it would be good to provide more information, like the history of Sekhapa and why only women dance Sekhapa. We do understand the history. How did it start? What is the difference between Sekhapa and Dinaka? Currently, we see older women dancing Sekhapa. We do not see young children, youth, and adults dancing Sekhapa. Is it because there is an age limitation? (MMWP1)

Figure 4-16: Community members browsed the Bohwa bja rena website during the mind mobilisation workshop



Note: mind mobilisation workshop participants browsing the heritage (Bohwa) website.

MMWP2 pointed out that the website was only showing modern traditional clothing, as illustrated in Figure 4.17. She said:

> I will talk about the clothing category. The clothes I see on the phone/Internet are modern. It looks like we are missing the clothes people used to wear in the past. Clothes like Thetho le Mpepana (apron) and cow leather. The

limited information means that the future generation will not know what people used to wear in the past.

Figure 4-17: Category of Balobedu female traditional attire



Note: This figure captures the traditional attire published on the Bohwa bja rena website and what MMWP5 categorised as modern. Source: Author, 2024.

The conversation between the participants revealed many uses of Maseka, as captured in the quotes below:

> In the past, people normally wore Maseka for healing purposes, especially those who suffered from wrist pain. (MMWP6)

> According to the old practice, we knew a girl was proposed for love when she wore Maseka. They bought Maseka and dressed her up. (MMWP3)

The other respondents pointed out the absence of some traditional utensils on the website and emphasised its potential role in educating children about their cultural heritage:

> The page about utensils shows Dithukhwana le Majomela. It is missing Digo, Difao, Dithepa le Ditelo. (MMWP5)

> I think the website can add value in the community by educating children because, as we speak, they do not even know the names of the traditional utensils. (MMWP5)

In addition to the cultural heritage content, the experimentation also involved genealogy information. This is what one respondent stated after browsing the information:

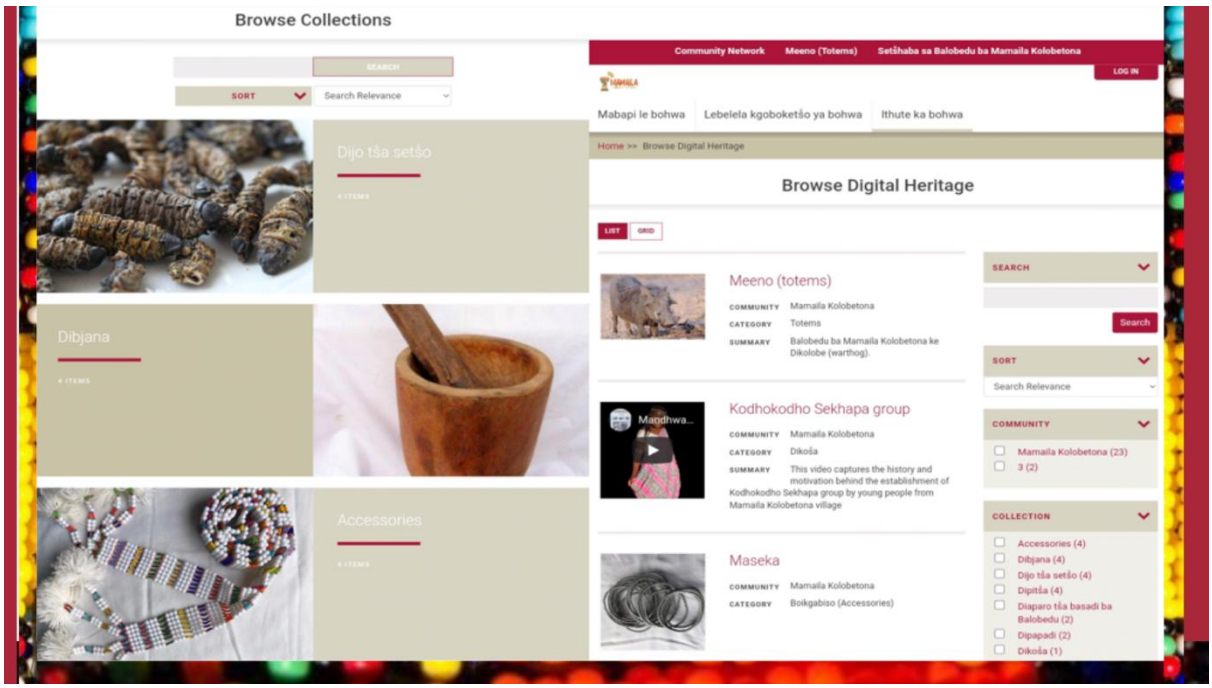
> I saw information about Mmakhutso's date of death, burial, and her family history (family tree) saved on the phone. The website shows that information will never get lost, like how we currently do not know where in the graveyard we end up losing information about the birth and dates of our people. So, if we keep it on the phone, we

will have the information. (MMWP10)

MMWP5 was happy about traditional products uploaded on the website, as illustrated in Figure 4.18 She said:

I was happy to browse the website because I learned about products I did not know. I see people wearing Maseka as accessories or fashion statements, but today, I learned about the symbolic meaning of Maseka.

Figure 4-18: Example of traditional products uploaded on the prototype website



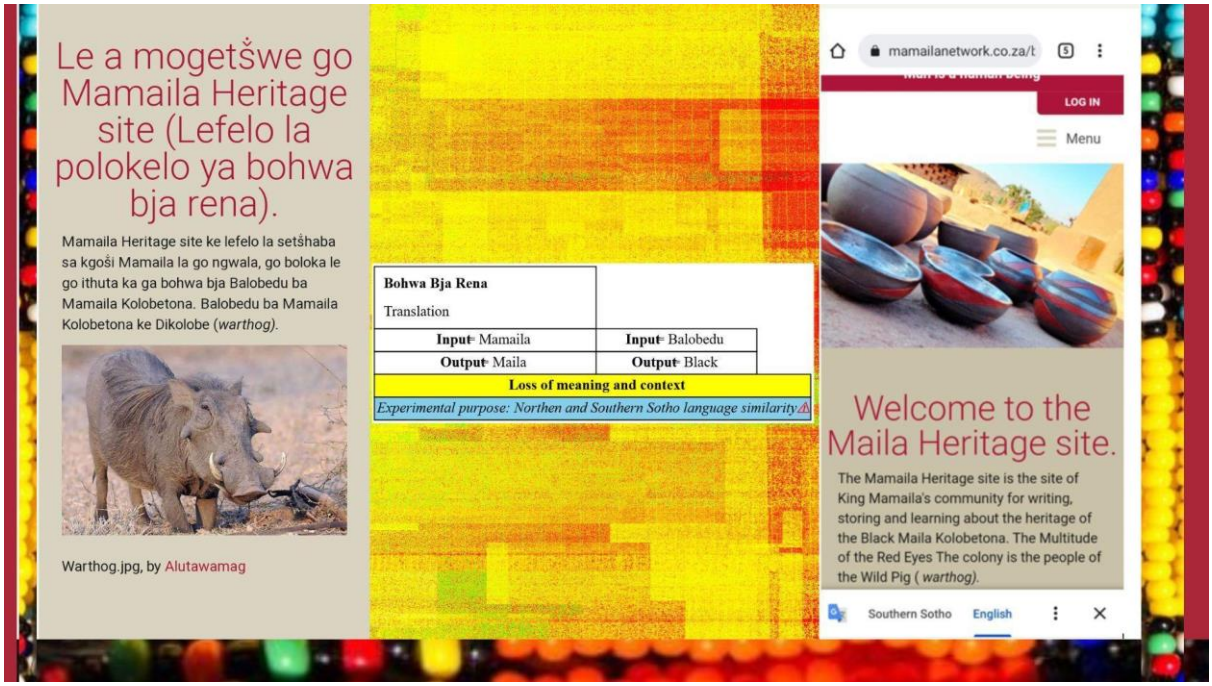
Note: This figure illustrates some of the cultural artefacts uploaded on the prototype website. Source: Author, 2024.

The experimentation with the Bohwa bja rena website uncovered challenges regarding machine translations. While the Southern Sotho and Northern Sotho languages have some similarities, the experimentation with Bohwa bja rena revealed difficulties in accurately translating the content using the Southern Sotho language. The prototype content was initially written in Northern Sotho and created using a content management system. During the testing phase, Northern Sotho was not available as one of the languages to translate the content into English. Given this limitation, I chose Southern Sotho to test the translation. The experimentation showed that the proper noun "Mamaila" changed to "Maila", and "Balobedu" to "Black". The translated text read as follows, as shown in Figure 4.19.

Bohwa Bja Rena original text written in Northern Sotho: Le a mogetšwe go Mamaila Heritage site (Lefelo la polokelo ya bohwa bja rena). Mamaila Heritage site ke lefelo la setšhaba sa kgoši Mamaila la go ngwala, go boloka le go ithuta ka ga bohwa bja Balobedu ba Mamaila Kolobetona. Moeno wa Balobedu ba Mamaila Kolobetona ke ba bina Kolobe (warthog).

Translation: Welcome to the Maila Heritage site. The Mamaila Heritage Site is the site of King Mamaila's community for writing, storing, and learning about the heritage of the Black Maila Kolobetona. The Multitude of the Red Eyes The colony is the people of the Wild Pig (warthog).

Figure 4-19: Translation of Bohwa bja rena content

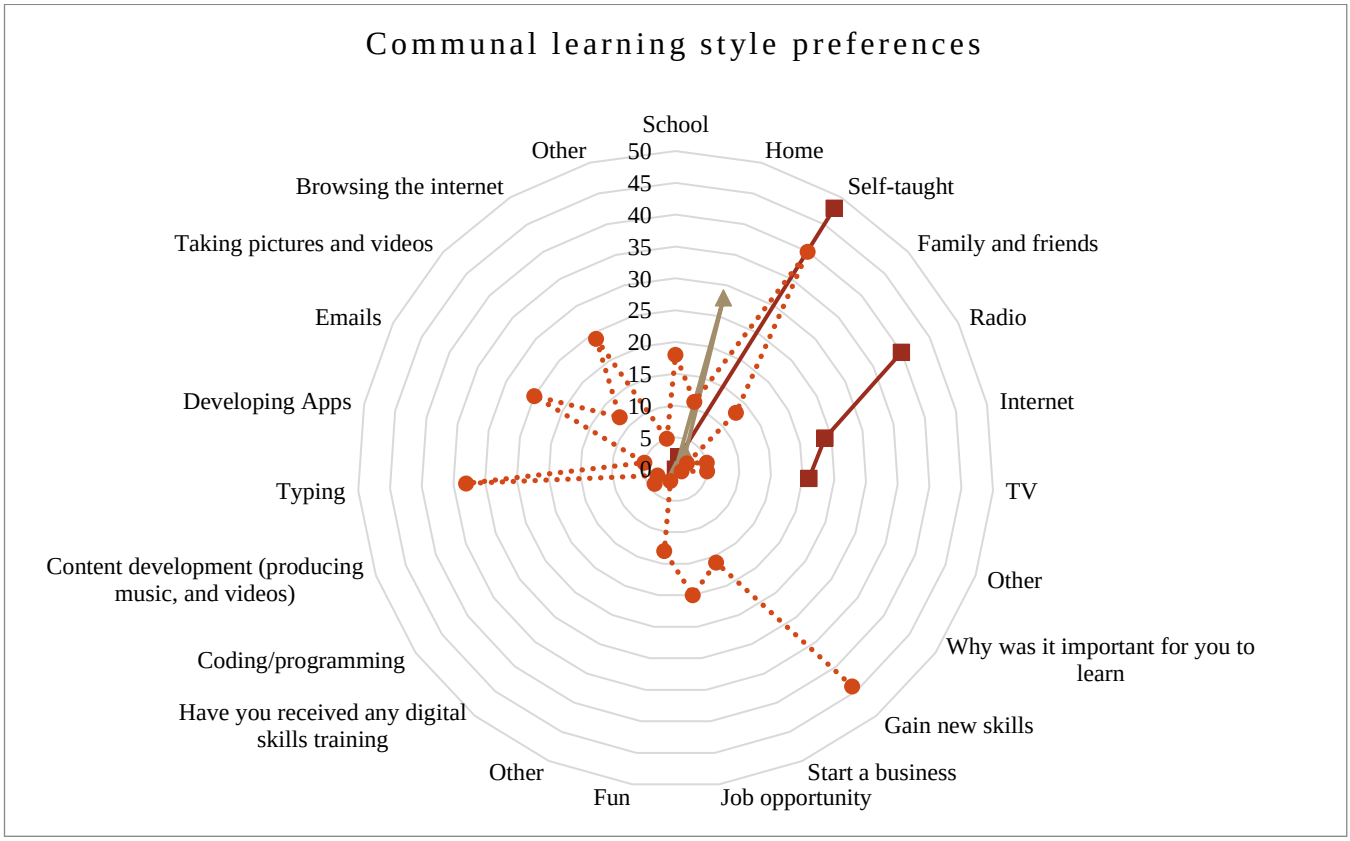


Note: This figure illustrates the translation of Bohwa bja rena content written in Northern Sotho but translated as Southern Sotho, one of the closest languages available on the Mukurtu system during the testing phase. Source: Author, 2024.

4.4 Digital skills

People in the MTA learn skills through informal learning approaches, as shown in Figure 4.20. Those participating in community projects such as agriculture and financial management rely on various learning approaches, including learning by imitation and observation. The most common approach is self-directed learning, where many people in the village take the initiative for their learning needs. In implementing community projects like agriculture, the most prevalent approach is individual initiative, followed by contributions from groups such as church groups, stokvels, and cooperatives, and support from families.

Figure 4-20: The communal learning styles preferences



Note: This figure provides insights into the communal learning approach employed by individuals in the MTA community.

With regard to digital skills, the survey highlights that MTA residents have lower digital skills in coding, programming, and content development. Furthermore, people are willing and motivated to learn new skills as they believe this will increase their employment chances, as shown in Figure 4.21. According to the respondents, the skills are essential for gaining new skills, starting a business, and finding job opportunities. The most common digital skills learnt are typing, browsing the Internet, and using email.

During the mind mobilisation workshop, participants noted that the prototype did not include most local content. Sewela, who attended the workshop, volunteered to curate content, including identifying local crafters, as shown in Figure 4.21. She experimented with content development, interviewing people in the community about their arts and crafts, farming, utensils, and Sekhapa music, and taking videos and pictures. Furthermore, during the testing of the Bohwa bja rena website, the older community members actively participated in discussions. They emphasised the need for more comprehensive information and provided historical insights about the artefacts uploaded to the prototype.

Figure 4-21: Action-research local content creators engaging with local crafters



Note: This figure illustrates the engagement with local crafters by one of the mind mobilisation participants who volunteered to contribute content to the Bohwa Bja Rena website.

This is the feedback as reported by the local content creator, based on the ongoing dialogue and feedback or reflection sessions (WhatsApp and telephone calls) between the researcher and the volunteer:

> Radio XXX conducted an interview some years ago capturing the history of Mamaila village. I tried accessing this recording but struggled to get the files because of gatekeeping. However, a CD is available from the Tribal Office. (Reported telephonically on 6 July 2021)

Moreover, she stated that the local content producers who are the founders of the youth-led Sekhapa Music Group expressed the need to be paid for sharing their content:

> The two leaders/founders visited my homestead to discuss payment for contributing content. They were under the impression that I was using them to get money. I told them we capture content to benefit our community and future children. My mother advised me not to engage with them further because they think I am using them to get money.

In contrast to Sewela's interactions with members of the community, particularly the founders of one of the youth cultural groups who participated in the cultural heritage experimentation, her interaction with the local crafters indicates their willingness to explore the use of the Internet to advertise their products online.

4.5 Digital infrastructure

The findings from the MTA provide insights into the state of rural telecommunications infrastructure. The mind mobilisation workshop and the focus group discussion participants highlighted challenges with regard to the cost and reliability of connectivity, as shown in Figure.22.

The focus group discussion perspectives on digital infrastructure indicate that the community faces notable challenges and disparities in digital access. For example, FGDP4 pointed out that, while she has the means to purchase data bundles, not everyone can afford data, particularly children who stay with their grandparents. FGDP2 highlighted the challenge concerning the depletion of data bundles:

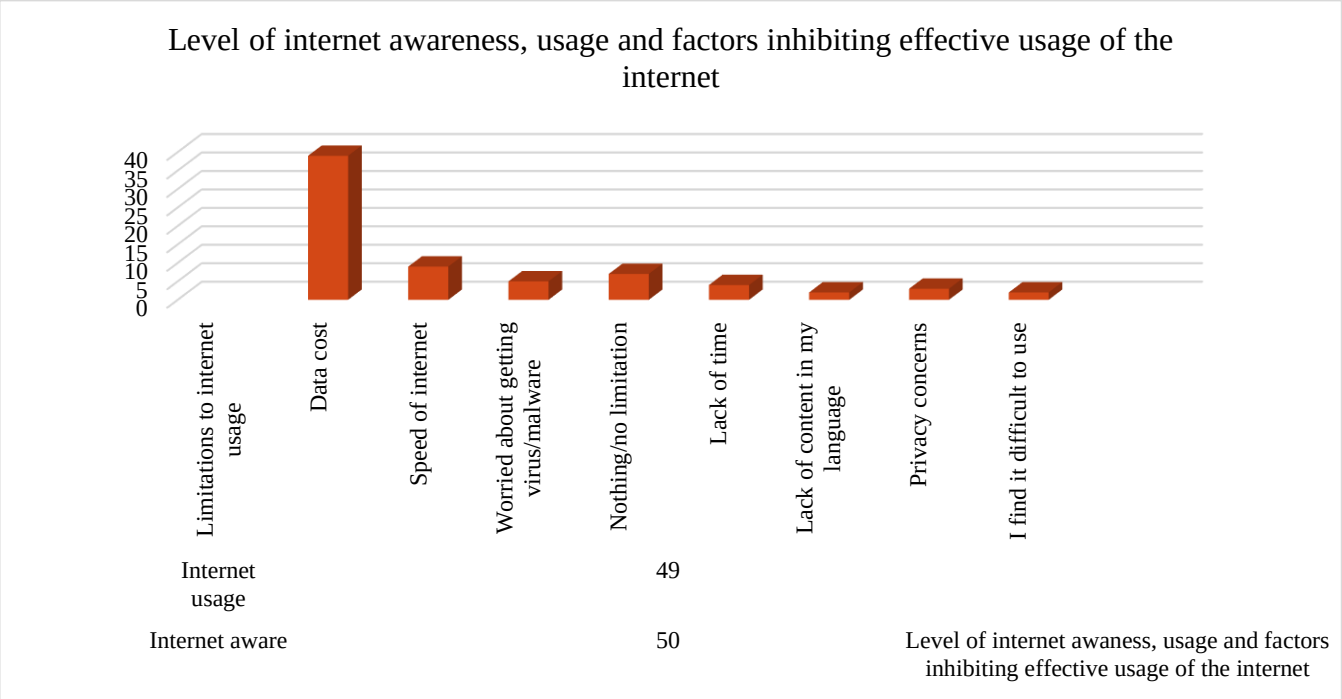
> I do not have R100 for one gig. The minute I log in to the Internet, one gig gets depleted when I am on question 1, and I must now buy another gig. Currently, people are using Zoom. When you are trying to participate within a few minutes, it tells you that you are disconnected. When you check why, it tells you no data.

Moreover, FGDP5 highlighted that sometimes people do not understand how data bundles work:

> Sometimes you have R100, but you do not understand how data works. You just tell your child that you will not be giving the child money to use the Internet just for playing sake. So, this means it is important to educate parents about the Internet. Sometimes parents have money to buy data for their children, but they just do not understand and then think the data bundles are just for playing purposes.

Of the 51 respondents, two reported having Wi-Fi connectivity in their households, while most depended on mobile connectivity. Most reported using the Internet on their mobile phones hourly, while a smaller proportion mentioned using it weekly. Figure 4.22 indicates the Internet awareness and usage level among surveyed individuals and the factors inhibiting use. It shows that respondents are aware of the Internet and are actively using it. The graph further illustrates various limitations on Internet use cited by respondents, including data cost, Internet speed, concerns about viruses and malware, lack of time, lack of content in their language, privacy concerns, and finding Internet use difficult.

Figure 4-22: Level of Internet awareness and use, and factors inhibiting the effective use of the Internet



Note: This figure illustrates that most respondents are aware of the Internet. Fifty respondents have used the Internet.

During the first phase of the observation process, the Bohwa bja rena website was hosted on a 5 Gig web server. The prototype content consumed 3.11 Gig (62 per cent) of the server space, costing R99,00 per month. The infrastructure challenges from the perspective of content management highlight that even if the content management system used for cultural preservation allows for the storing of multimedia files (audio, video, and photos) on the website server, content managers or creators face hosting costs as the multimedia content requires a large hosting space. The storage use indicates that, as the website expands, it will require more space on the server. YouTube provides alternative storage space, but this presents a privacy challenge if the community does not wish to make its content available to the public. Moreover, the observation from the experiment is that while Mukurtu Mobile enables users to contribute offline content and sync it with the website, during the testing of Bohwa bja rena, this capability was only available for IOS.

4.6 Digital leadership

The focus group discussion respondents pointed out that they are responsible for facilitating the local DT ecosystem. According to the leaders, the Internet is a vital resource for the community. When asked about the role of leadership in ensuring that the MTA community has access to the Internet, the focus group discussion respondents suggested a step-by-step process for achieving Internet access in their community.

FGDP1 emphasised the importance of awareness and communication. FGDP2 stated: “People need to understand how they can use Google, so that they do not end up saying you brought the Internet here, but I do not even have a smartphone. I do not even know what Google is.” FGDP5 stated that the leaders must “work through the Tribal

Office through the stakeholders and must look for a company that can help us to have Wi-Fi. Once we find the company, the next step is to strategise how we can educate people on the ground about the project so that they can understand what it is and how to use the Wi-Fi."

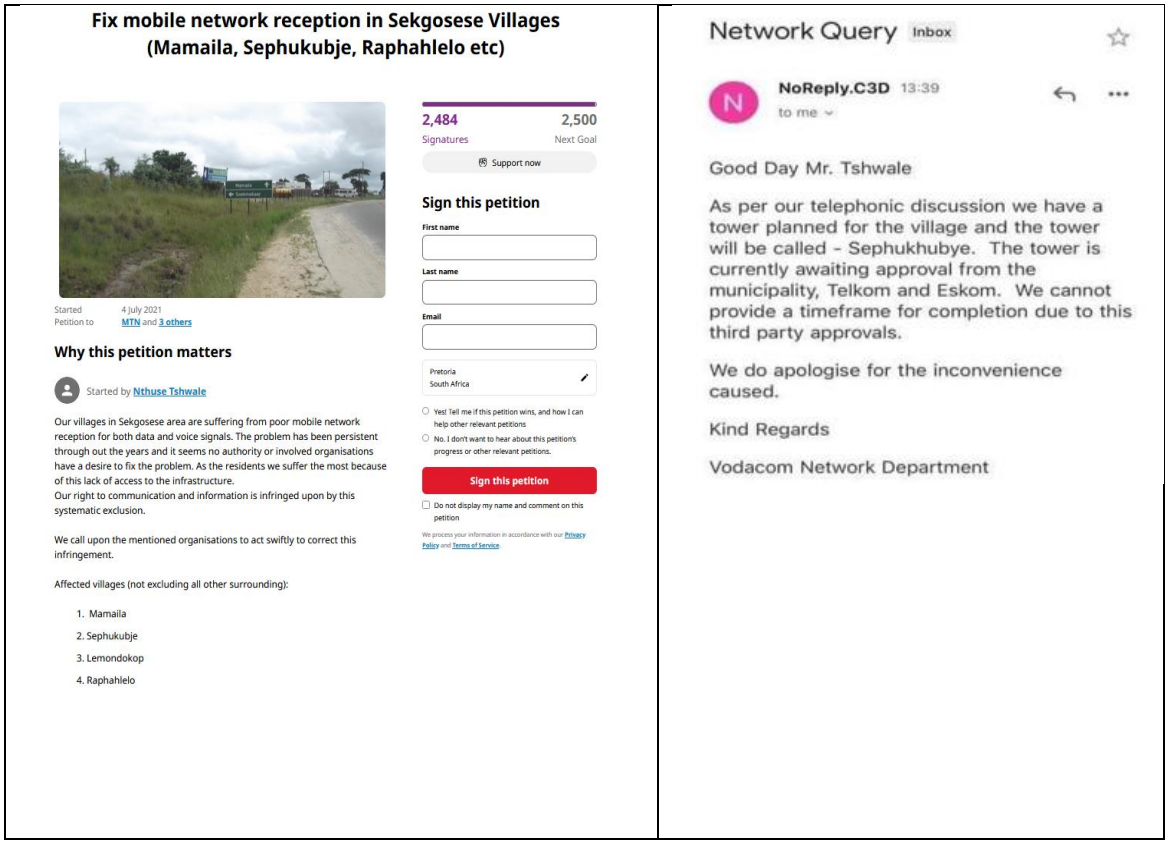
The survey results show that the respondents view the government, tribal offices, and non-governmental organisations (NGOs) as the primary entities responsible for providing digital solutions in the community. Concerning individual roles, the survey showed that a sizeable number of respondents do not see themselves as having a role in ensuring community participation in the Internet business or value chain, although they believe that they have a role in sharing their cultural content with the world.

During the research process, the researcher observed that Mamaila faces challenges related to digital infrastructure, particularly mobile network connectivity. The community submitted a formal petition to telecommunications companies, as shown in Figure 4.23. According to Tshwale (2021), the lack of access to reliable mobile infrastructure infringes on residents' rights to communication and information, leading to their call for swift action to address the problem by the relevant organisations.

> Our villages in the Sekgosese area are suffering from poor mobile network reception for both data and voice signals. The problem has been persistent throughout the years, and it seems no authority or involved organisations have a desire to fix the problem. As the residents, we suffer the most because of this lack of access to the infrastructure. Our right to communication and information is infringed upon by this systematic exclusion. We call upon the mentioned organisations to act swiftly to correct this infringement (Tshwale, 2021).

Figure 4.23 also shows the response from a mobile operator to Mr Tshwale. The operator informed Mr Tshwale about the planned tower named Sephukubje. However, the operator was awaiting approvals from third-party entities, including the municipality, Telkom, and Eskom. The response does not provide specific timeframes for the completion of this infrastructure project, stating that this depends on the approval processes of the involved parties.

Figure 4-23: Community petition for improved mobile network infrastructure



Note: This figure captures the community petition submitted by residents of various villages in the Sekgosese area and a response from the operator outlining the intention to deploy a tower in Sephukubje.

4.7 Highlights from the cultural preservation case study

The data indicates that the MTA community faces challenges related to cultural preservation and identity. Modernisation, globalisation, and the impact of the 4IR have contributed to the erosion of traditional cultural practices and language. Despite the challenges, the findings indicate that the adoption and use of digital technologies in the MTA community are also influenced by the deep-rooted connection between spirituality, identity, and cultural preservation, as individuals often use these technologies as tools for maintaining and expressing their spiritual beliefs and cultural identities. The case study also demonstrates that knowledge systems are dynamic and adaptable.

In the next chapter, I present the findings from the experimentation with the Leola funeral scheme fintech prototype.

CHAPTER 5 ：MICRO-LEVEL PERSPECTIVES: CASE STUDY OF COMMUNAL FINANCIAL MANAGEMENT (FINTECH PROTOTYPE)

5.1 Introduction

This chapter presents the insights from the case study of the prototype experimentation with the Leola funeral scheme. The chapter is organised according to the research analytical framework, starting with the cultural practices and processes dimension. followed by inclusive digital usage and adoption, digital skills, digital infrastructure, and digital leadership. The survey and the community focus group discussion indicate that the Leola funeral scheme is one of the primary financial and cultural practices in the MTA. The left side of the figure illustrates community rules like Leola (funeral scheme) and Motshelo (local tax) used by the MTA and actively practised by the community members, contributing to social cohesion. According to the survey results, the Leola funeral scheme is one of the cultural practices that community members are aware of and adhere to. Additionally, the respondents reported that concerning the community rules used by the MTA to promote social cohesion, Leola is the most used rule, followed by the local tax and the by-laws governing the graveyard under Diphiri. The respondents indicated that the Leola funeral scheme is the primary cultural practice that weaves the community of Mamaila together because it promotes social cohesion and unity.

In addition, the focus group discussion respondents noted that Leola is one of the community practices that might benefit from technology. The next section provides insights from the experimentation with the Leola funeral scheme. The section starts with an overview of the Leola funeral scheme, followed by the requirements gathered from the representatives of Maola groups in the MTA, the prototype presentation, and feedback from the prototype testing session.

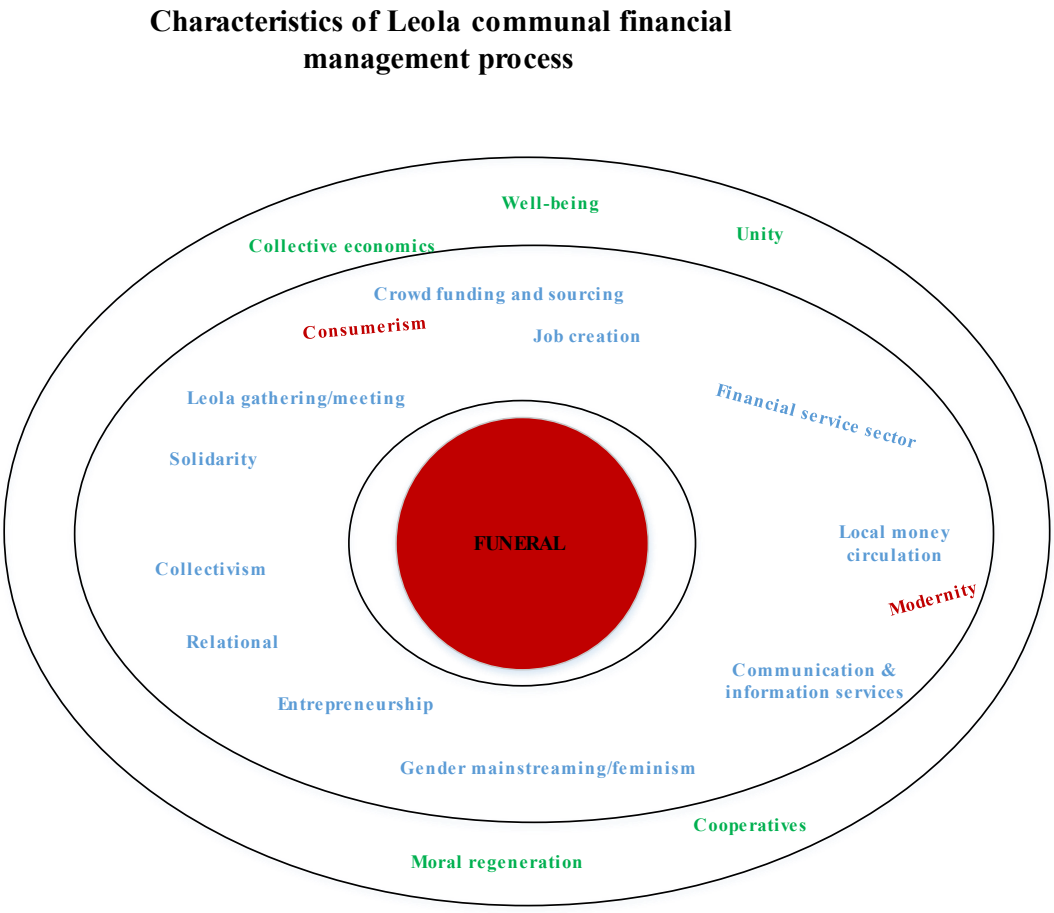
5.2 Cultural practice and process

The Leola funeral scheme is a communal funeral scheme in the MTA that provides financial and non-financial support to bereaved families. The representatives of Maola describe the scheme as a crowdfunding system that does not require community members to contribute money monthly; they contribute on a need-to-need basis when there is a funeral. The respondents further highlighted that Leola helps the community by bringing people together. It also relieves families of the burden of organising the funeral because they can depend on each other.

> Leola is Letšema because we organise ourselves and divide tasks and responsibilities according to the streets. For example, when we attend the Leola meeting, we can discuss other issues like safety and security (chairperson of SSSS Leola section).

Figure 5.1 illustrates the key elements of the Leola practice as described by the respondents. Death triggers the activities of the Leola funeral scheme. The practice encompasses fostering community well-being and promoting solidarity and collectivism. In addition, Leola contributes to the local funeral economy.

Figure 5-1: Key elements of the Leola funeral scheme



Note: This figure illustrates that death triggers the Leola process and indicates the positive and negative aspects of the process, as shared by the respondents. Red concepts are the negative aspects, while blue and green are the positive aspects that the respondents associate with Leola. Source: Author, 2024.

The respondents expressed concerns about potential negative influences such as consumerism. For example, the chairperson explained:

> We have realised that some people have wasteful tendencies. They waste people's resources by just distributing the food and unreasonably serving people. We learned that in such cases Diphiri (hyenas) who are doing the hard work of digging the grave would return from the graveyard and not find enough to eat.

The respondents pointed out that while Leola is primarily a funeral scheme, it serves multiple purposes. The community sees it as the highest order of funeral crowdfunding, which caters for everyone irrespective of their socio-economic status. It serves as a multiple purpose platform for social interaction, community networking, and the provision of essential advisory services, particularly by elderly members of the community. Moreover, Leola is a communication tool for disseminating messages throughout the community and tackling pressing issues such as water scarcity. The respondents emphasised that the practice also holds the potential to generate employment

opportunities, and discussed hiring individuals for graveyard maintenance and exploring financial management strategies:

> The practice is not only for collecting money, but there is also a social interaction network that provides advisory services to members because we have elderly people in the group.

The chairperson of the SSSS Leola section explained further why she participates in the Leola process:

> I love socialising. I love being in the forefront. I love serving in the structures. I love being the first to receive the news directly from the source. I also love taking notes when I attend meetings. I want to make sure that I provide proper feedback to the people. So, they did not make a mistake by nominating me. I love being part of Leola.

While the community respects the Leola funeral scheme as a communal practice, the respondents pointed out some challenges. Some members of the Maola groups have expressed concerns that the scheme can encourage unwanted behaviour, such as members of some groups expecting special treatment when they attend funerals. Furthermore, the respondents reported that, in some cases, newly emerging Maola groups lack proper governance and transparency, resulting in financial misuse and fraud. In some cases, Maola groups encounter problems when dealing with some households, as captured in the quote below.

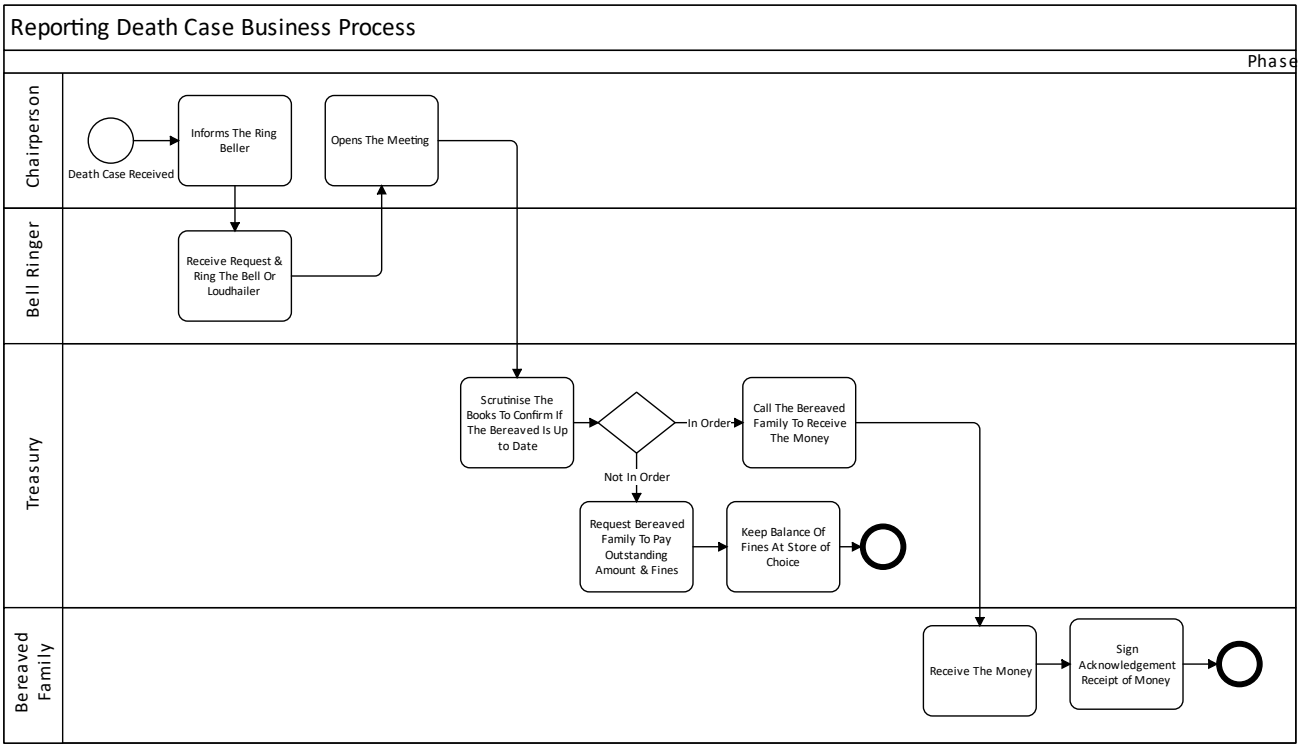
> In some houses, we encounter problems because they curse or devalue the role played by Diphiri. Some even go to the extent that they do not want them. But we often understand that some people behave like that because they have not experienced death and the waste associated with it. So, we are not impatient when dealing with them. In some houses, the people take us to Kgorong (tribal court). They open a case for us because they are not aware that our by-laws are approved by the tribal office, and we have presented our business case to the tribal office to argue for the implementation of our by-law. (Chairperson of SSSS Leola section)

Other financial processes interact with the Leola funeral scheme to complement the resources raised by the funeral scheme. Malapa a lekane (which means that families or households differ based on class and access to financial resources) is another form of funeral crowdfunding focusing on the groceries and household essentials required to provide catering during the funeral. The participants in Malapa a lekane are households that do not always have the financial means to procure the desired food items for funerals. Participating members buy food essentials that they agree on (the product and the quantity) every time there is a funeral for one of their members. Malapa a lekane provides mealie meals, sugar, cake flour, bags of potatoes, milk, jam, bread, and kitchen utensils to the bereaved family. Lebele (rotational, like a tyre) is another form of communal funeral crowdfunding.

The Leola funeral scheme is convened to discuss funeral- or burial-related issues and to collect money from the participating households. Members or individual households contribute R20 to the bereaved family whenever there is a funeral. For example, a Leola funeral scheme group comprising 227 households could collect up to R4 540 if all participating households contributed. Once the money is collected and accounted for, the nominated representatives deliver the money to the bereaved family. Sometimes, the family's representative collects the money and signs for it as proof of collection. In the MTA, the Leola funeral scheme is managed at a village section level

by a chairperson, secretary, treasurer, and bellringer.[14] The practice is governed by a constitution signed by Chief Mamaila. However, participation in the Leola funeral scheme is not compulsory for community members. Figure 5.2 shows that the process starts with the chairperson of the Leola funeral scheme receiving a death report from the household and ends with the bereaved family receiving the collected funds.

Figure 5-2: Leola funeral scheme end-to-end process



Note: The Leola process as explained by the research respondents. Source: Author, 2024.

The participants who attended the mind mobilisation workshop peer-reviewed and validated the Leola funeral scheme process as documented by the researcher. They provided more information about how the practice differs from one group to another, depending on the group's maturity. The participants highlighted that Maola groups have different rules. However, the groups in Mamaila apply more or less the same standard rules in the constitution signed by the chief. The Leola funeral scheme is widespread in all the villages in Mamaila. The groups have different maturity levels, and the rules differ from one community, group, or section to another. One view was that some executive members misused funds from fines issued against defaulting members in some groups. The respondents indicated that it is essential for such groups to learn from mature groups such as Mamaila to avoid causing distrust in the community or even going to jail. Such groups could start by developing their constitutions or affiliating with the governance structure established by the MTA, which plays a role in conflict resolution.

The validation process served as a peer review and knowledge exchange platform for representatives of Maola

[14] A designated community member who rings the bell to announce a death.

groups from another village. The conversation revealed that some of the groups in other villages are not applying the values of collectivism and personhood. Some executive members of the Leola funeral scheme misuse resources because of a lack of governance systems. One affected group member asked the workshop participants to provide her with more information to report best practices to her members:

> I need help and information so that I can be able to go back to my group members and inform them about the good practices of the Leola funeral scheme because as I am listening to the different speakers, we are not running our Leola funeral scheme properly. There are practices of maladministration, conflict of interest, corruption, misuse of resources and nepotism in our group. (MWP3)

In contrast to MWP3's concern, the representatives of two Maola groups from the same village shared that their Leola funeral scheme operates like the Mamaila groups. The groups indicated that they have processes to ensure group accountability and compliance with Leola funeral scheme norms, principles, and values. The participants encouraged the concerned person to work with her group by establishing a committee to coordinate the governance process to ensure uniformity and fairness:

> I am from the same village as you; our Leola funeral scheme group has no problems because we follow the same process as the Mamaila people. Our Leola funeral scheme is even registered here at the tribal office. If we have a conflict, we come here. Listening to you, and because I know your group, the problem is that your group lacks rules. Everyone does as they please, and one day you will be arrested. (MMWP2)

> I am also from the same village as you. We do not have the problems you are sharing. I am personally responsible for the finances. We fine people, and I keep the money with me. I have been doing this for a long time, and my group has never complained about me. If I go somewhere, I hand over the books to someone to ensure that the members do not suffer should there be a funeral. We use the money generated from fines towards whatever that we need, like buying pots, and tents for our group. (MMWP4)

5.3 Inclusive digital adoption and use

The next section presents perspectives from the focus group discussion, an interview with a representative of the Leola group, the mind mobilisation workshop, and the prototype testing session. The respondents highlighted that they do not use technology to manage the Leola processes, but they view technology as something that could help them to manage the process. The presentation below started with suggestions about how technology could help participants to manage the Leola processes, followed by a presentation of the prototype design and feedback from the testing workshop.

The focus group discussion respondents shared that technology could benefit Leola, one of the community practices. According to the respondents, the community can use technology to create updates about activities like Maola, to enable remote transactions, even for those outside the village, and to assist in managing contributions and missed payments. Furthermore, technology can inform community members about important meetings.

> Also, in cases where there is a discussion of money, people can coordinate and manage the finances, which means

> that people can manage the process without having to travel from one place to another. So, technology enables the process. Technology can also help us to create updates about activities such as Maola, and we can also use the same apps to pay or transfer money even if we are outside of the village. Technology can also help us to manage our contributions and missed payments. It will also help us to inform us about meetings just like the COVID-19 app can inform us about people who have the virus and are in proximity with us. (FGDP4)

Moreover, the chairperson of one of the Maola groups pointed out that they do not use technology to report deaths in her section. She stated that they asked the bellringer to report deaths using his phone, but he refused because, according to him, cell phones are disruptive, and he also did not want to be bothered by people who called him even when it was not necessary:

> Currently, we do not use technology because a person like [name omitted], our bellringer, refuses to use a cell phone. We tried or suggested getting a phone for him, but he refused because he says the phone is disruptive since people will be calling him non-stop. So, we thought that if we could get them a phone, members could have our numbers. They could just update or alert us by phone instead of physically coming to report the death case. We can use technology to alert and update members. (Chairperson of SSSS Leola group)

According to the chairperson of the SSSS group, technology can help the bereaved family to report the funeral and can help her group manage their assets by taking pictures of the assets that are signed out. The participants in the mind mobilisation workshop supported this view: "We can use the Internet to monitor our assets even if we are at home because we do not have the same processes for managing our assets" (MMWP3). Another participant added:

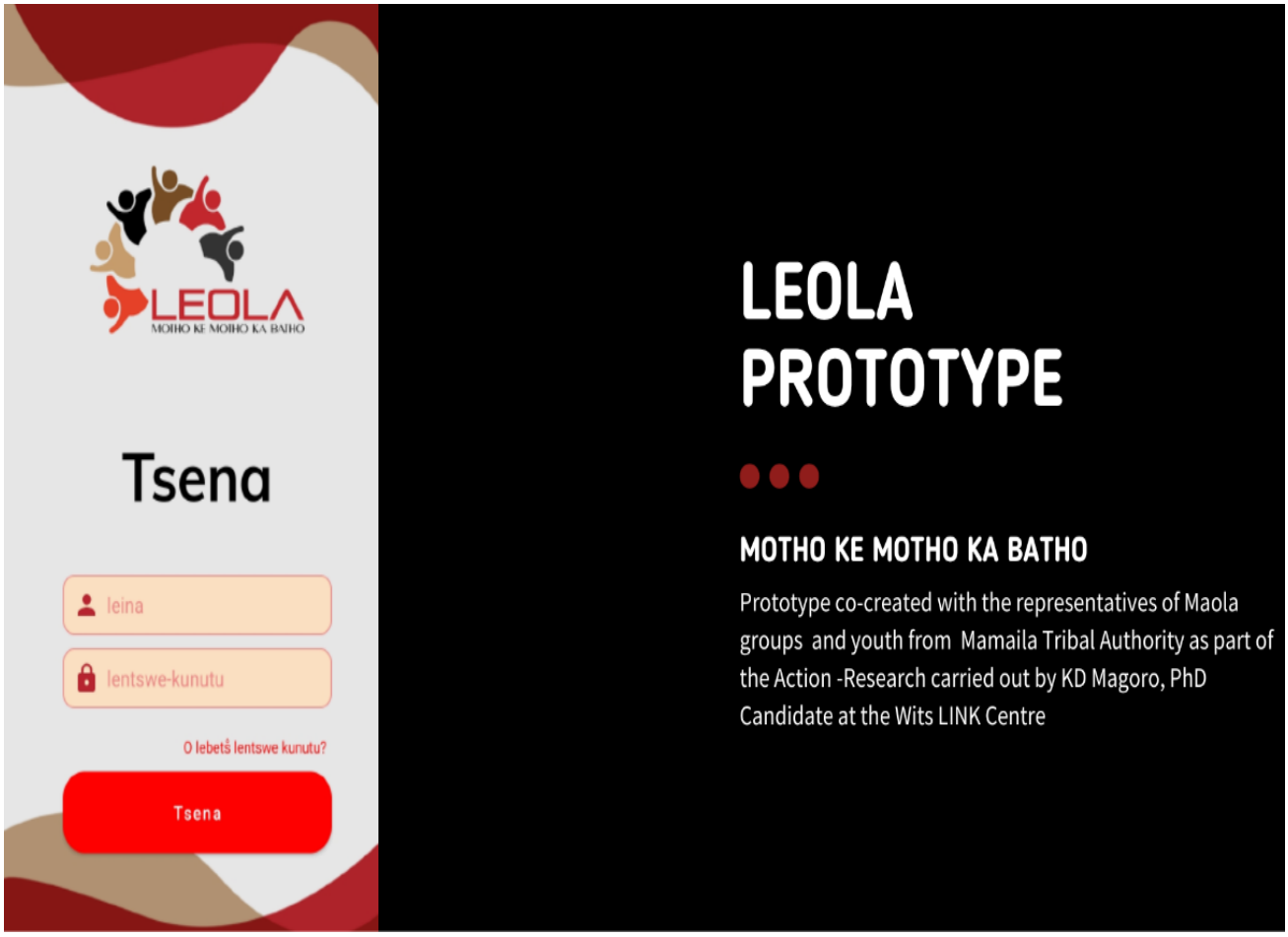
> Regarding assets, for example, I do not keep the keys to the Leola house. It is kept by the person who is assigned to manage the assets. I think technology could assist because it would mean that the assigned person who releases the assets has the authority to inform the bereaved family about the available assets that could be issued out to track fair distribution amongst the members. (MMWP1)

MMWP6 suggested that the app must have the capacity to create groups to co-manage the asset process to ensure continuity and service delivery because the process will not depend on one person. In the words of the participants: "This would mean that each Leola section will have a dedicated page for members to be able to view their information." Furthermore, the respondents indicated that the Internet could help them to share knowledge to promote good practices in the various villages and they could use it to monitor their assets, given some of the challenges experienced by different groups.

Figures 5.3 to 5.9 illustrate how the user aspirations were translated into a prototype. After several iterations, we renamed the prototype: originally it was the Leola funeral scheme app; its new name was the Motho ke Motho ka Batho community app to enable the integration of functionalities that are beneficial to the broader community irrespective of their non-participation in the Leola funeral scheme. The presentation focuses on Leola as one of the key modules in the prototype. The module aims to enable the management of the Leola funeral scheme with financial record-keeping, communications (funeral announcements), information-sharing, neighbourhood safety or incident reports, etc. Household members can only view group information, including the total amount collected and outstanding fines. Ordinary members of the community can report incidents and MTA notifications. The

executive approves and disseminates the death notice to all group members.

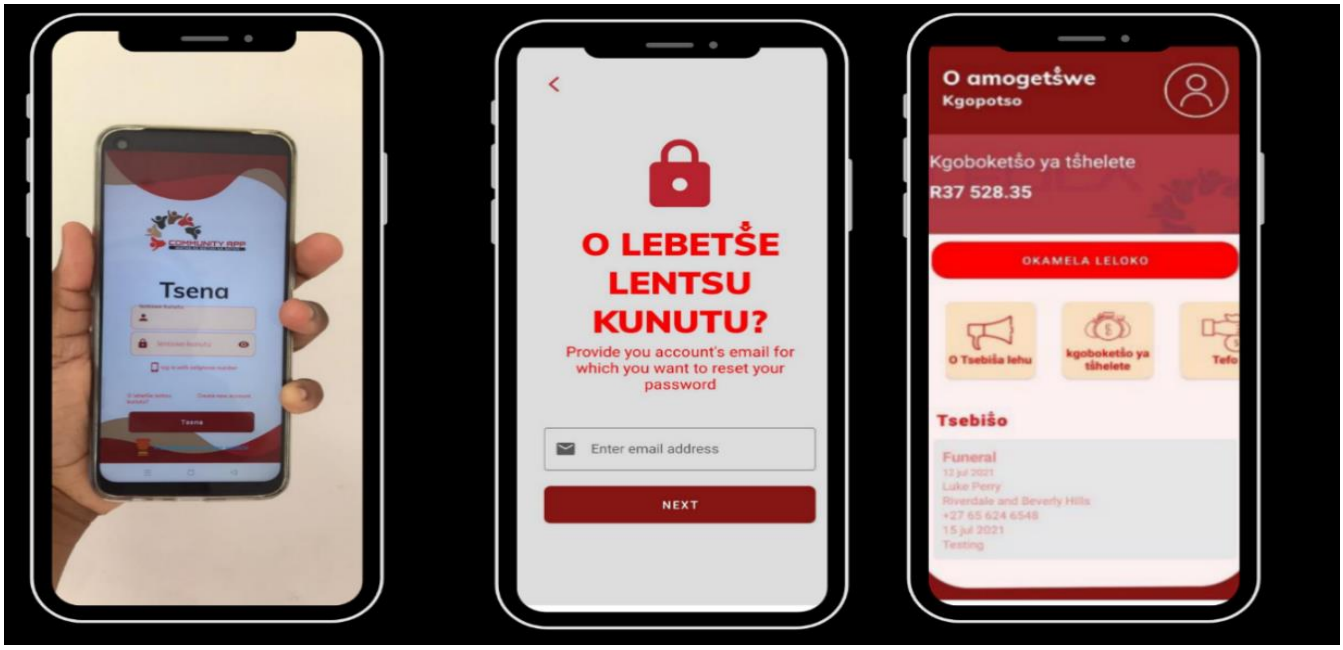
Figure 5-3: Prototype based on user requirements



Note: The prototype was co-created with representatives of Maola groups and youth from Mamaila.

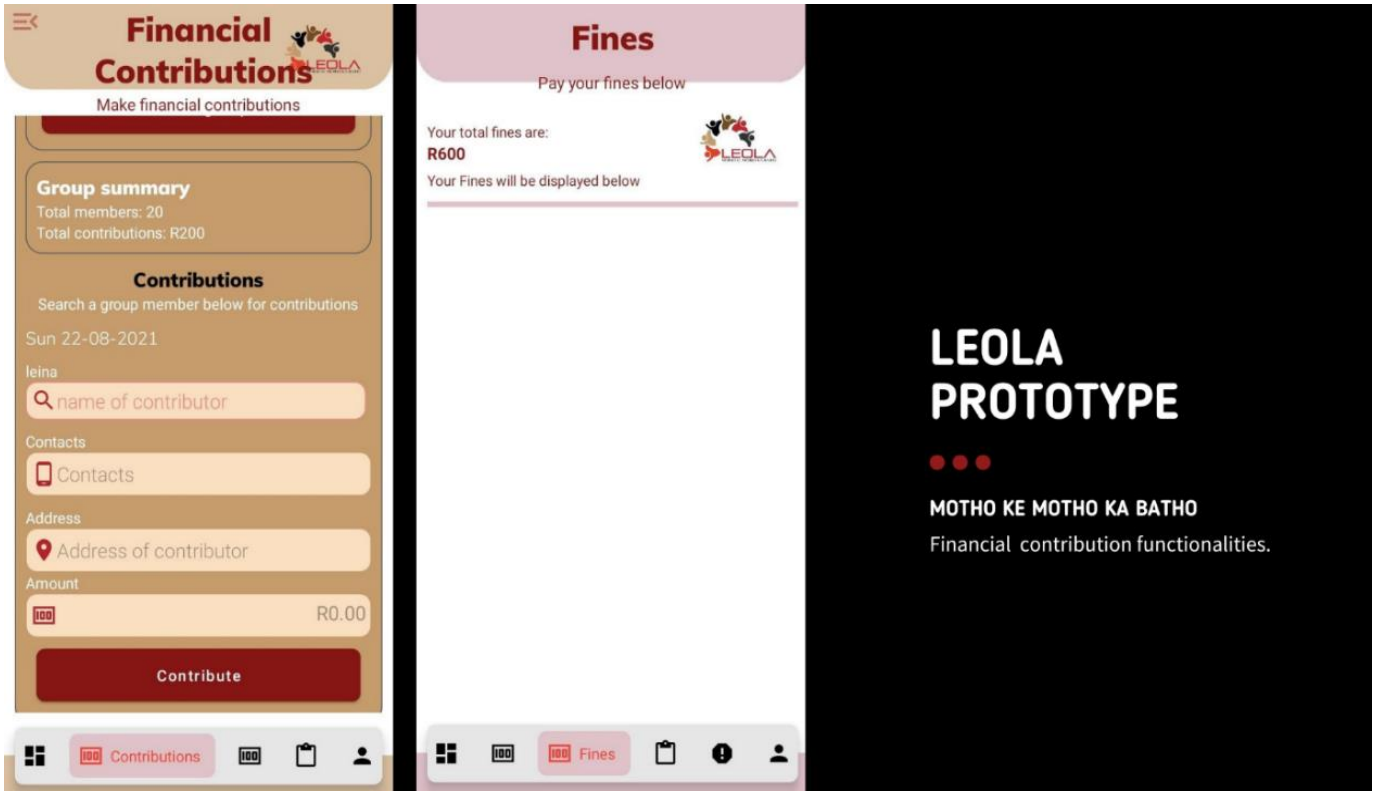
During the development of the Leola prototype, the experimentation included creating a Northern Sotho (N. Sotho) interface. Furthermore, the youth from Mamaila village provided translations, as shown in Figure 71.

Figure 5-4: Example of N. Sotho interfaces for the Leola prototype



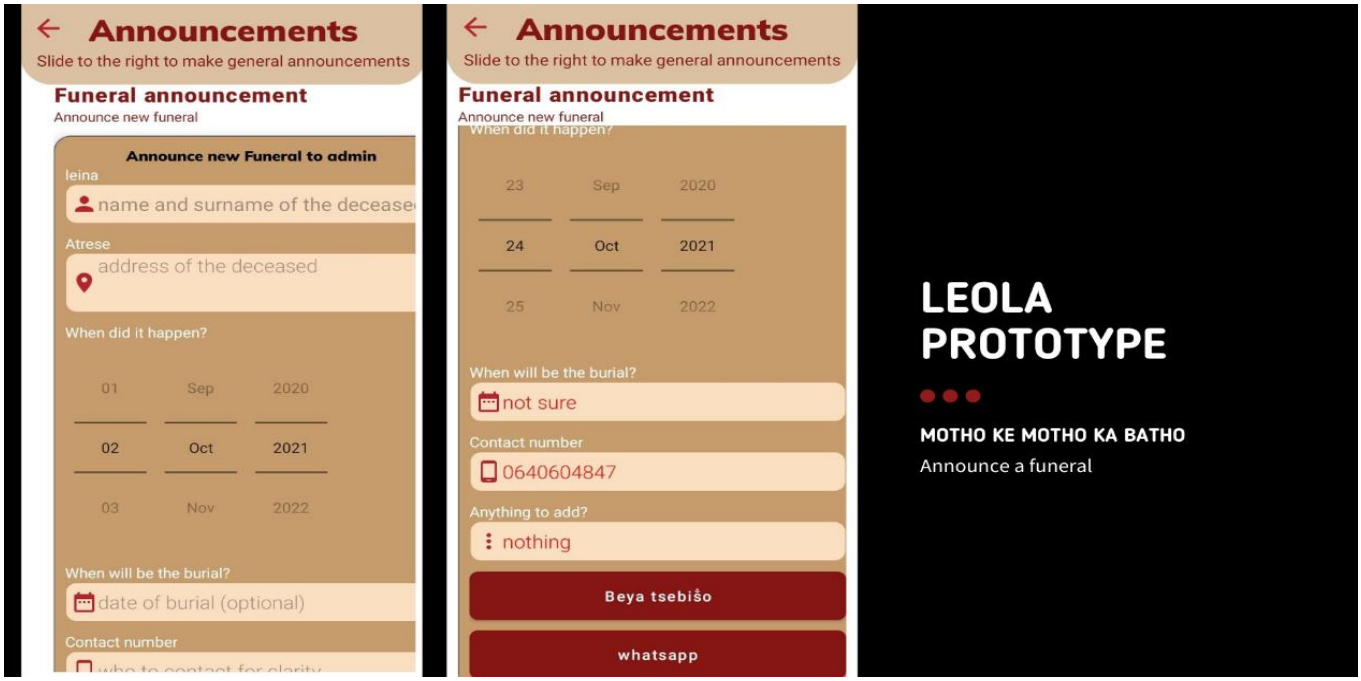
Note: This figure illustrates some of the Leola prototype interfaces translated to N. Sotho. The interface also illustrates the limited capabilities with the translation of English to N. Sotho.

Figure 5-5: Households can view their contributions and fines and report deaths Maola groups



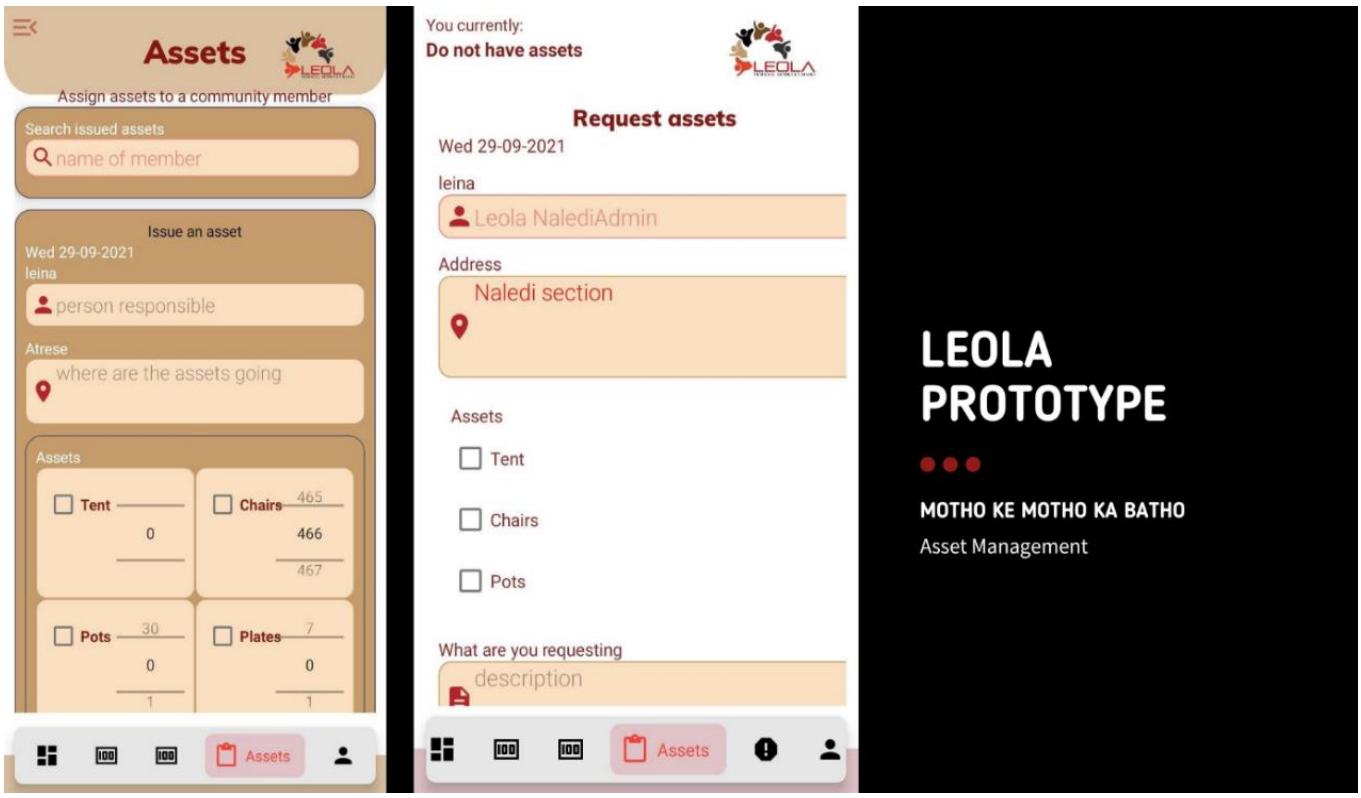
Note: This functionality demonstrates the potential for household members to make contributions, view the group contributions, and view their household fines. Members can only view their information and total group contributions.

Figure 5-6: Announcement of death by household members



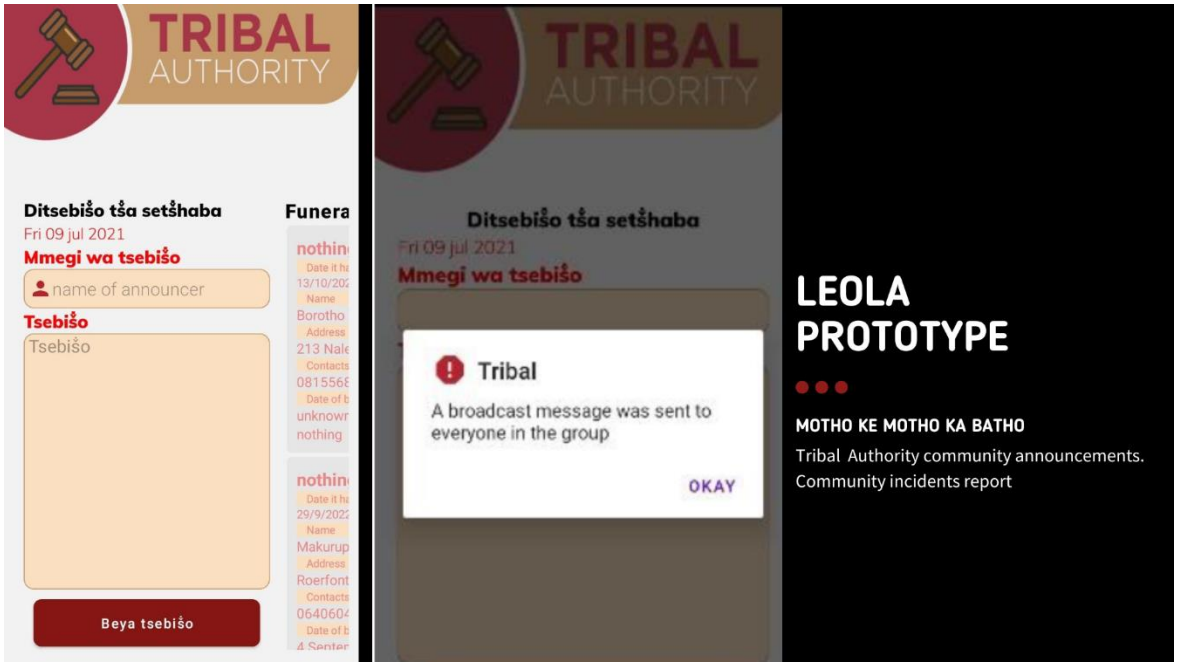
Note: This figure illustrates the functionality for household members to report a death.

Figure 5-7: Asset management functionality



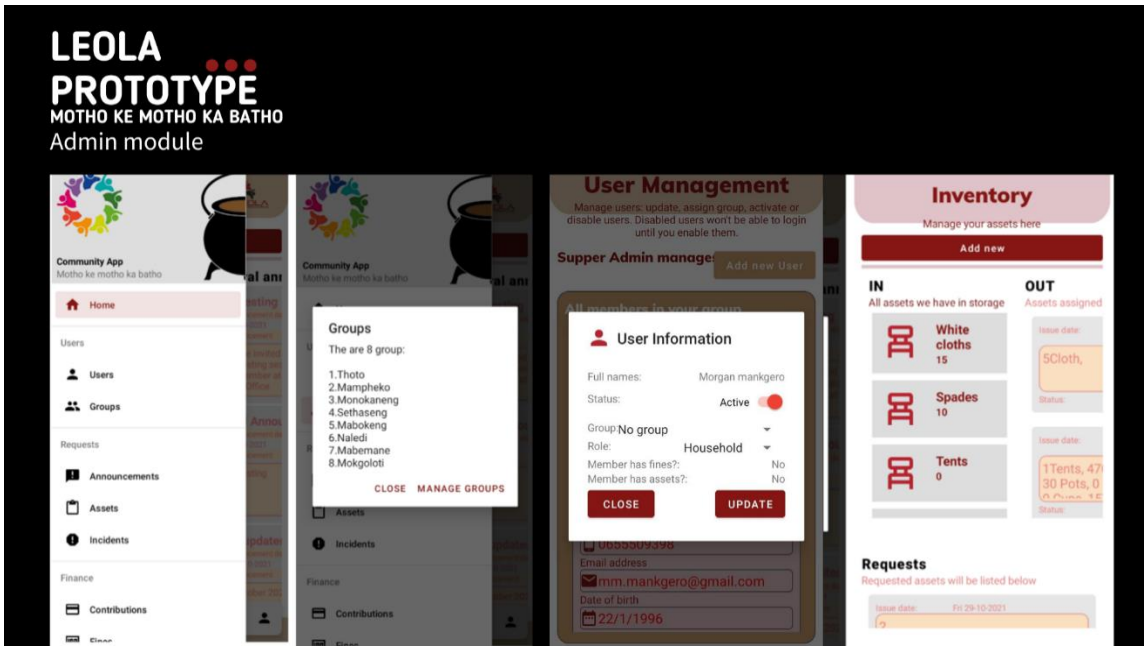
Note: This functionality demonstrates household members' potential to view the group inventory and request assets.

Figure 5-8: The prototype allows MTA officials to send notifications to the community



Note: This functionality enables the MTA to broadcast community messages to various Maola groups and community structures.

Figure 5-9: An example of the backend of the Leola app



Note: This figure illustrates the backend for the executive members of Maola groups to track financial contributions, fines, and assets issued to their members.

PrototypeTester_Leola1 from the recently established Leola group, composed mainly of young members, expressed

satisfaction with the design of the app. She expressed a desire to test the app and to transition from the conventional use of books: “We are happy with the app’s design. We want to try it out and hopefully move away from the traditional way of using books.” The tester highlighted that the prototype could resolve payment disputes in community groups. Another participant emphasised: “I want to add to what the CXXl group is saying because we face many challenges, especially when it comes to people who do not stay in the village” (PrototypeTester_Leola2). According to the tester, people who do not stay in the village often claim they gave their children the money: “So, I think the app will help us access the financial records in 24 hours because we take a long time to meet as a group. So, if a person is disputing or claiming that they made payments, I can just open the app and show them the financial records.”

Moreover, PrototypeeTester_Leola1 highlighted that the app could assist Maola in managing its assets: “We have seen that we can use the app to manage our assets.” Additionally, the members of Leola highlighted that it would benefit individuals sending money to Leola, as it aids in payment tracking and record security: “The app will also help those who send money to people to pay Leola on their behalf. It will help them to track the payments” (PrototypeeTester_Leola1).

The chairperson of one of the first Leola groups in the community, who also served as a tester, highlighted that her group encountered difficulties in record-keeping. They initially believed that their records were secure, only to later discover that they were not:

> Our files once got wet, and we had a problem because the tribal office was looking for a copy of our constitution. We could not provide it to them because it was wet, our files got wet, and we could not even see the writings on the document. Another way I think the app could help us is that when people report funerals, the message will go to the Leola leaders, who will approve that the message is true and then distribute it to all group members. It will eliminate fake reporting of death cases. (Chairperson of SSSS Leola section)

However, PrototypeeTester_Leola4, raised concerns: “How will the elderly who are not literate be able to use the app without getting defrauded by their grandchildren or children? In our groups, we have families who do not read and write.”

5.4 Digital skills

During the testing and co-creation of the app, the researcher observed that the young participants had different levels of digital skills. For instance, in the initial offline testing (version 1) of the app, testers were required to download and install the app on their mobile phones. However, this proved to be a challenging task for most of the testers. Of the four testers, only one successfully downloaded, installed, and tested the app without assistance. The remaining three testers needed guidance and support from the researcher throughout the process, from installation to navigation. The testers reported they could install version 0.2 of the app via Google Play without assistance. They could download the app, install it, and create accounts independently without the researcher’s help. Concerning the members of the Maola groups, the researcher observed that while the executive committee comprises older people (born before technology), young adults who are homeowners are also part of Maola, and

these groups have some basic digital skills. In addition, the executive members group who some of them are former migrant workers who are on retirement and others working as government administrators can read and write in Northern Sotho and English. For example, the executive committee of Maola in the MTA has a constitution, as shown in Figure 5.15. Furthermore, the older people reported that they use technology to make phone calls.

The youth provided feedback based on their role as assistants during the testing of the prototype, where they interacted with and received input and questions from the older community members. The quotes below capture feedback from the youth who assisted the older people. The youth who assisted the older people with testing reported that some members of Maola expressed concerns about expensive data and poor network connectivity. Assistant Tester 1 mentioned that the same group further suggested incorporating notifications like ringtones into announcements to make them recognisable when users log into the app. Assistant Tester 1 also reported that others had asked questions about the payment system and the cost of data. Assistant Tester 2 reported that "they approved the prototype and shared that the app once rolled out will help them to keep the record of their respective Maola for future generations". The tester recommended that the next step should be an engagement with the young people in the community to come on board so that they can assist. In the words of Assistant Tester 6:

> Those Madalas [older men] said they would love to use the app. They said the only way to trust the app is by getting a slip [proof of payment] after paying because they do not want scammers. They asked if they could pay via bank transfer and if they would not be charged to use the app.

At the same time, others saw it as something that could help people in different provinces to track their money, to manage their assets, and to report incidents:

> Our elders were happy about the app, and their understanding is perfect when it comes to the point that the app is easy and safe for everyone who is in a different province to know how their money is managed. On another point, it shows that many people can use the app if they have a problem, e.g., if a person has broken in or someone wants to steal, it will protect the community, and it will be an easy way without calling or spending much airtime. (Assistant Tester 4)

Assistant Tester 5 reported:

> Kometi ya Leola (the Leola committee) understands the issues of bringing new technology because some information is not safe in the book. They are willing to learn the new system, but they agree that they will be using two methods: the app and the books. Our community is happy because many dibjana or dilo tsa Leola (Leola assets) will be safe, and people will be responsible when we can take images before and after borrowing to compare the assets. Moreover, they also highlighted that when it comes to fines, people will no longer be robbed because all the information will be recorded.

In contrast, Assistant Tester 3 expressed his disappointment, noting that he believed the workshop was focusing on older people:

> I understand that the people of Maola have the greatest impact, and somehow, we will face challenges when

> introducing change. The youth must be involved in the process, which is what these elderly people do not want. I believe you got the point from the old man, Mr. PPPP, raising an issue about how the whole thing will go about when we involve kids who feel they are not being given any money by the very same elderly to pay for "Leola" ... He was trying to justify that they do not want to involve the youth into the elderly stuff.

The youth who commented on what he sees as the intention of the older people to exclude youth emphasised that the introduction of the app would face potential resistance from those born before the millennial generation. Moreover, he suggested that the roll-out requires education and awareness-raising. According to him, reaching out to the youth, older people, and women is challenging:

> The elderly women of the past believed men should take charge because they were the heads of the household, and back then, men were heads of families without being questioned of any sort. Hence patriarchy. With youth, it is going to be difficult. Hence, I am not part of the XXX political party because of the very same people. Youth is still being undermined. (Assistant Tester 3)

He suggested ways of reaching out to the community, especially youth. According to him, the best way to access the youth of Mamaila is through school visits and university gatherings, "else the rest are addicts of substances and distant from everything you cannot convince them otherwise unless we go door to door."

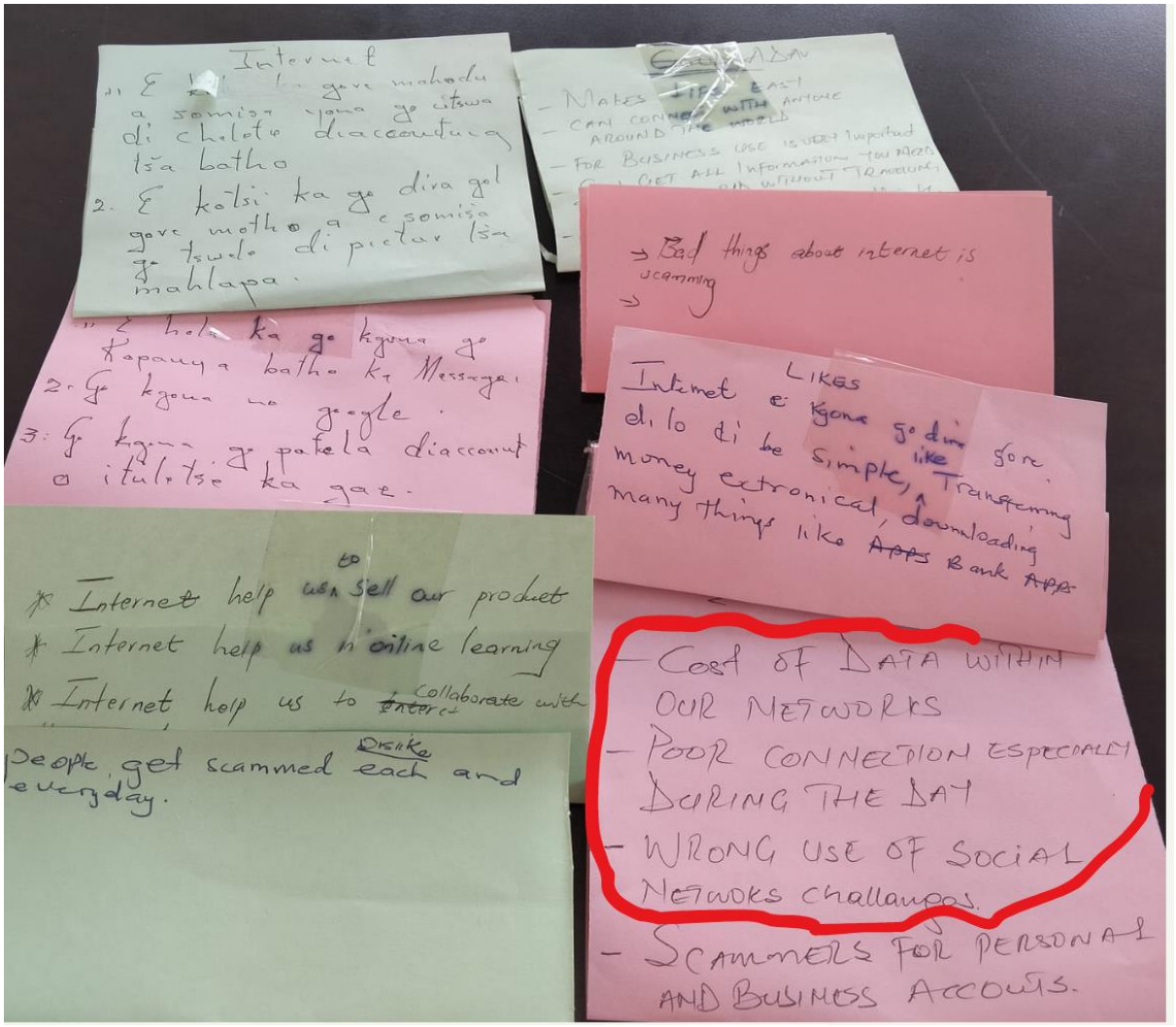
Data highlight that while some household members of the Maola groups may not be literate, the executive committee members can read and write. The constitution signed by Chief Mamaila in 2018 governs the different Maola groups in the MTA (see Appendix T).

5.5 Digital infrastructure

In contrast to the previous dimension, the collected data on digital infrastructure as part of this case study is limited because the Leola process is predominantly managed by older individuals less familiar with digital tools and processes. Despite the limitations of digital infrastructure, I observed that the majority of the older members of the Leola funeral scheme do not have access to smartphones, the internet, and Gmail accounts. However, some of them reported that they occasionally, use WhatsApp video calls to communicate with their children and grandchildren who live in Gauteng, attributing this to the COVID-19 lockdowns. One participant shared that her child, who works in Gauteng, bought her a smartphone, but she did not bring it to the workshop. She left it at home, opting for her regular phone instead because she only uses it occasionally.

The members of Leola expressed concerns, as illustrated in Figure 5.10, regarding the affordability of data and unreliable internet connectivity. These issues limit their access to digital services and information, thereby affecting their ability to utilise digital applications effectively.

Figure 5-10: Perspectives from the mind mobilisation workshop about challenges with the Internet



Note: This figure illustrates some of the digital infrastructure challenges expressed by the members of Leola funeral scheme.

The community-driven infrastructure development within Leola is evident from the following initiatives:

> Our Leola group constructed a house specifically to store Leola assets such as chairs, tents, and equipment used at the graveyard. Each household donated a brick toward the construction and contributed funds for cement. Despite minimal security—a simple lock—the houses have remained untouched by theft or vandalism. We also have pots and chairs. 100 chairs. We give these assets to the bereaved family for utilisation (free). It depends if they want them or not. They only pay f they want to use the Leola assets for functions like weddings. (Chairperson of SSSS Leola section)

Figure 5.11 captures some of the Leola assets bought through crowdfunding. The house is known as Leola house, and it is used as a storeroom for the pots, chairs, and other equipment are used to support members of Leola to run the funeral services.

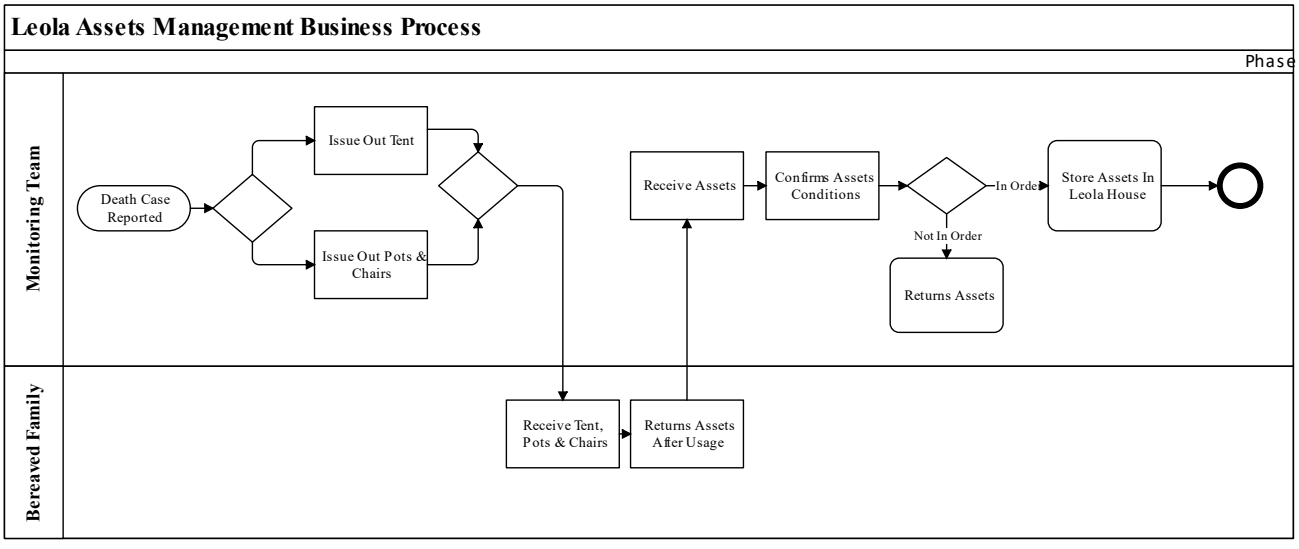
Figure 5-11: Example of Leola assets



Note: This figure captures examples of some of the Leola assets acquired through crowdsourcing and fines generated from household members.

Figure 5.12 shows the asset management process, a standard service provided to household members of the Leola funeral scheme group. In some cases, a tent is issued to the bereaved family for use during the funeral proceedings, for various activities. Additionally, the groups provide pots and chairs to the family free of charge. If the family wishes to use Leola assets for functions like weddings, they are required to pay for these services, with members enjoying a discounted rate. Following the event, the bereaved family returns the assets, and their condition is assessed by the Leola monitoring team. If necessary, the family is asked to return the assets to their desired state, involving proper washing or the replacement of lost items. The assets are stored at the Leola house, constructed by group members, with a designated person responsible for maintaining the asset register and safeguarding the key.

Figure 5-12: Leola funeral scheme assets management process



Note: This figure illustrates the asset management process for the groups with assets. Source: Author, 2024.

5.6 Digital leadership

The respondents reported that communities under Chief Mamaila adhere to clearly defined local protocols as part of their communal governance systems, which intersect with the Leola process. In the words of the Chairperson of SSSS Leola section:

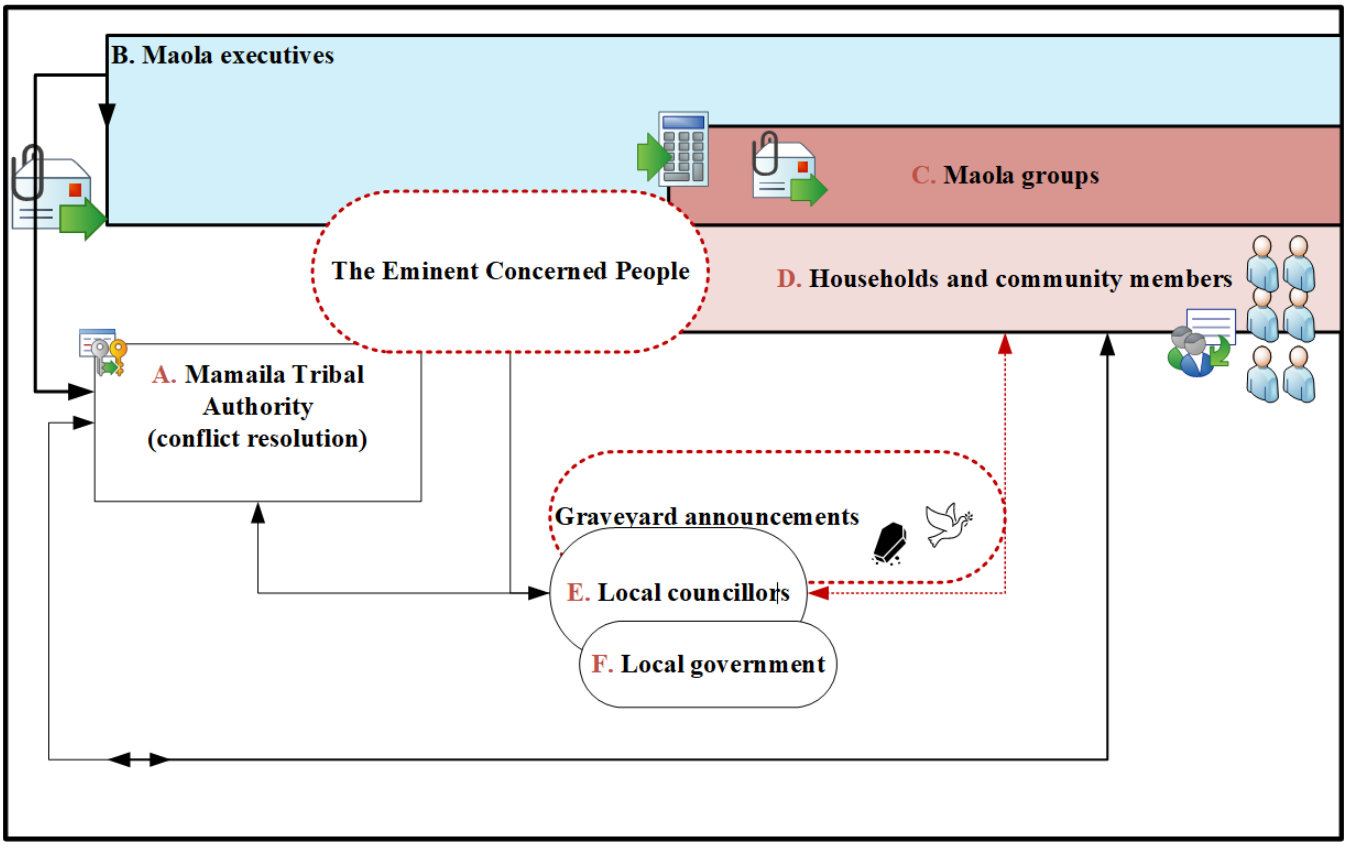
> The tribal office is using the practice as a platform to disseminate messages in the community tribal called the leadership to inform them about community messages that must be communicated to community members. The role of the leadership is to ensure worth they provide feedback to the section or household within one second the village will no receive the message and remain updated.

Figure 5.13 illustrates the communication protocol and information flow as described by the respondents. According to the Chairperson of SSSS Leola section, the community uses Leola meetings to discuss challenges such as lack of water:

> During our gatherings, we also discuss issues affecting different sections of the community. Once we discuss and agree on the way forward, we nominate a delegation that will be tasked with taking the issue or resolution forward. This has led to the formation of a group called the Eminent Concerned People. The Eminent Concerned People coordinate or identify community issues that require intervention from the tribal authority or any other structure. All this is done with the guidance of the tribal authority and their validation. (Chairperson of SSSS Leola section)

The respondents highlighted the role played by the Tribal Authority in the Leola process, emphasising its responsibilities in conflict resolution, providing guidance, and ensuring adherence to cultural norms. Additionally, respondents highlighted that cooperation within the community is reinforced through implicit threats. They noted that individuals are warned of being taken to “Mosata” (tribal office) if they fail to comply with community expectations. This method ensures compliance and cooperation, as community members understand the consequences of non-cooperation.

Figure 5-13: MTA Communication protocol and information flow



Note: This figure illustrates the communication protocol and information flow and interactions between the Tribal Authority, Maola structures, households and the local councillors. Source: Author, 2024.

The respondents shared that the only time they meet outside of funerals is when the tribal office calls them for a meeting to disseminate a message from the Tribal to the community. According to the respondents, very few people respond when the tribal office directly calls for meetings because they no longer fear the Nduna (chief) and do not trust politicians. However, through Leola, people gather quickly.

> After informing/delivering the message, we return to the tribal setting as part of the tribal consultation process. In the past, political parties used to unite the community, but people no longer trust politicians due to corruption, lack of transparency, and disrespect towards the community. People do not respond to politicians when they call for community meetings. Even when the tribal office calls for meetings, very few people respond. People no longer fear the Nduna, but through Leola, people gather quickly once the bell is rung. (Chairperson of SSSS Leola section)

Many role-players have different responsibilities in the Leola funeral scheme, as captured in Table 5.1. According to the respondents, Leola promotes the participation of both men and women with clearly defined roles and responsibilities.

Table 5.1: Roles and responsibilities in the Leola funeral scheme

Actor	Role
Diphiri (the village hyenas)	Male gravediggers are responsible for preparing the grave and managing their equipment. Females are responsible for enforcing the code of conduct, catering equipment, cleaning pots, cooking, etc.
Women	Responsible for catering and equipment
Households	Households are members of the Leola funeral scheme group; they contribute money and human resources when required.
Tribal Authority	It is responsible for conflict resolution.
Local businesses	They provide products and services for running the funeral, including financial management services; this enables the Leola funeral scheme groups to keep their savings at their preferred shops for future use.
Eminent Concerned People structure	This community-based structure comprises different Maola sections. The structure serves as the link between the community and the tribal authority.
Children	Some children participate in the graveyard cleaning process.

Note: This table outlines the various roles and responsibilities of actors involved in the Leola funeral scheme, as reported by respondents in the community.

One respondent shared that women play a role in the Leola process and engaging with the bereaved families and assessing the situation to identify challenges facing households.

> Women can think fast, they are able to come up with ideas/solutions for how to solve the challenge. Women have the capability and agency to solve problems within a short space of time. I remember there was a time when people used to brew local beer when there was a funeral. Resulting in Diphiri (young men) fighting for beer and scalp meat. There used to be kgoro every Monday to discuss the conflict. Tribal decided to cancel alcohol and sculp meat. The family could give this to Diphiri if they want to, but it is not compulsory. This is because it used to be a practice long time ago as part of removing the tent after the funeral. (Leola member, SSS section)

The respondent highlighted concerns regarding the brewing of local beer during funeral ceremonies, noting incidents where firewood intended for other purposes was used without permission.

> The day a decision to ban alcohol was taken I was part of the meeting. I was the only woman representing the Emminent concerned people. When they suggested the alcohol ban I responded and said “Salute” They asked why? I was in support of the decision. I told them that alcohol triggers theft. When we start engaging with the beer brewing process we even steal people’s firewood specific for brewing alcohol, wood that they left in the bush for

> later collection. We even enter people's yards in their absence looking for beer-making equipment. Therefore, my suggestion was that we start serving juice with ICE. The men then complained that the juice might be fake. So they insisted that women must dig the grave. I then raised my hand again indicating that if women are going to dig the grave, men will also have to cook, and they must take note that women bring dishes/utensils and food supplies to they funeral. (Leola member, SSS section)

During the testing session of the fintech prototype, the youth assisted the older members of Maola in testing the app. The quotes below provide insights into the testing and demonstration supported by the youth, as the older members of the Leola funeral scheme group did not have the skills and the appropriate devices to test the app. The testers demonstrated the app and facilitated the conversation in the local language. For example, Assistant Tester 1 in Figure 5.14 explained the incident report functionality through the Sepedi expression "Sebata kgomo", which means calling for help when facing danger or attack.

> The incident report is like Sebata kgomo. Like when you have a problem at home, if something happens in your household, you can use the app to report the case, and then it will inform other people who will come to help. People can report things like water bursts. (Assistant Tester 1)

Figure 5-14: Testing dialogue and functionality demonstration



Note: Dialogue between Assistant Tester 1 and community members explaining the incident report functionality as sebata kgomo to simplify the purpose of the functionality.

Figure 5.15 captures the intergenerational testing session between Assistant Tester 2 and some of the older members of Maola, as captured in the dialogue below.

Figure 5-15: Dialogue during the testing session



Note: One of the youths demonstrated the Leola prototype to representatives of Maola.

Assistant Tester 2: It can report to all members that today, for example, Leola la Mabokeng collected R4 000.

Leola member: Hmm (in awe/appreciation).

Assistant Tester 2: This message will be sent to all group members, whether they are there or not.

Leola member: It will be delivered to your phone because the amounts will be captured and recorded by the treasurer, and they already have your number.

Assistant Tester 2: Yes, because the app can put your mobile number. So, this is the app that is being developed to help you.

5.7 Highlights from the Leola funeral scheme case study

The experimentation with the Leola funeral scheme demonstrates that the value of self-determination rooted in the ontology of Botho in adversity governs the community of Mamaila. In conclusion, the case study of Leola demonstrates community leadership through the structured roles and responsibilities assigned to leaders in the funeral scheme. In the next chapter, I present the findings from the conceptual agri-tech prototype.

CHAPTER 6 ：MICRO-LEVEL PERSPECTIVES: CASE STUDY OF EARLY AGRI-TECH CONCEPTUALISATION

6.1 Introduction

In this chapter, I present perspectives from farmers and digital transformers experts working in precision agriculture (Internet of Things and innovation hub managers) on the intersection of cultural knowledge, technology, and farming. The chapter is organised according to the research analytical framework, starting with the cultural practices and processes dimension. followed by inclusive digital usage and adoption, digital skills, digital infrastructure, and digital leadership. The research respondents for the agri-tech case study were one IoT expert, three farmers, and a software engineer, coded as Malekutu, Molemi, Selemela, Mpho, and Batau who was born and bred in Mamaila. The data presentation starts with the meso-level perspectives of the five respondents, followed by the perspectives of Batau farming in the MTA.

6.2 Cultural knowledge systems, practices and processes

Mpho highlighted that in the dawn of democracy in South Africa, the younger generation adopted a Eurocentric way of living, resulting in the older people being responsible for food production: “South Africa has seen youth shying away from the agricultural value chain. It is almost like there was pressure for the youth to adopt the Eurocentric way of living, dispensing with their culture.”

The respondents, Malekutu, Molemi, Selemela, and Mpho, emphasised the importance of exploring cultural or traditional farming methods as inputs into modern farming. According to the respondents, leveraging old and modern farming methods could unlock hidden values, enabling innovative farming solutions and the development of new farming value chains. Malekutu indicated that when approaching agriculture and science, culture must be considered as either adding value or unlocking hidden treasures. Mpho stated that, recently, people are reviving the indigenous knowledge system in the agricultural value chain, specifically in permaculture and the Seed Bank initiative. Molemi pointed out that he did not study farming but learnt about farming from his grandfather: “I did not study farming. I learnt from my grandfather, one of our community’s first farmers. I saw that the quality of the farming we had before was very good, but we changed how we did farming. Although the tools did not change so much.”

The respondents emphasised the difference between traditional and modern farming. In the words of Molemi: “the quality of farming is no longer good. So, many people are now trying to return to traditional farming methods. However, I think the best way is to see how we can match the old and the new way of farming (modern approach with the good technical approach we had before).” Mpho highlighted that, recently, there has been a revival of indigenous farming methods in the agricultural value chain through organisations such as the Slow Food Movement. She stated that the “Slow Food Movement seeks to promote the growth of food or other food production utilising or informed by indigenous knowledge systems. If you come to my farm, you will find a patch of land where I am growing food using indigenous seeds.”

The next section presents the perspectives from the lived experience of Batau Farming in the MTA.

6.2.2 Perspectives from Batau farming

I begin this section by presenting Batau's journey into farming, organised according to the research analytical framework. Batau was born and bred in Mamaila, he is a qualified engineer by profession. His farming career started when he joined his family farm. He later established his farming entity known as Batau. The journey of Batau was inspired by a market opportunity that presented itself to him. According to Batau, unlike many farmers who struggle to secure a market for their products, he found the market before establishing his farming enterprise. In his words:

> What inspired me in farming was the market. I found the market before establishing my business. What happened is that we were all farming, my dad, me, and my brother, and they had planted spinach. Then, one day, when I was in Modjadjiskloof, I noticed that one of the supermarkets did not have spinach on the shelves. I decided to ask them if I could supply them with spinach. They said yes, where is it? I said it was at home. They told me to bring the sample. The following day, I went there with the samples. They liked my sample. I used the market opportunity to ask my family's permission to expand the business and establish my own entity, and they agreed.

Eleven years later, Batau's business has grown into a farming entity that employs more than 15 people from the community. Over the years, Batau has made a name for himself in the farming community. He is the recipient of multiple awards. He is the provincial chairperson of the African Farmers Association of South Africa (AFASA) in Limpopo. His farm serves as a training centre for university and technical and vocational education and training (TVET) college students studying agriculture.

Batau supplies products to retailers in Limpopo province. According to Batau, what differentiates him from the other local farmers is that he specialises in spinach. He compares himself to ZZ2, which specialises in tomatoes: "Although I mix a variety of crops like beetroot, cabbage, spinach is my special crop just like the tomato is ZZ2 special crop as he never goes a day without planting tomatoes. The other thing is that I am farming for business, and the objective is making money."

Concerning the farming practice, Batau emphasised that he uses cow dung (Mmutela) illustrated in Figure 6.1 as his main fertiliser because it helps to make the soil fertile and enhances water retention. He said that he dislikes using chemicals because they damage the soil over time, making it weak and unproductive. Batau learnt about cow dung as a potential fertiliser when he overheard older people talking about how they used to apply dried cow dung to destroy the wetlands:

> Young as I am, I have found value in old methods. I am applying old methods in modern society, which is not a problem for me. People must move with time. Take the old methods and apply them now using the current systems. We must not throw things out because they are old. We must learn from old practices, improve, or innovate just like the old architecture is now coming back as modern houses. If we do not want to be lost, we must not curse and discard old practices because this is the wrong way.

Figure 6-1: Mmutela dry cow dung at Batau farm



Note: This figure illustrates the dry cow dung (Mmutela) used as fertiliser at Batau.

Moreover, Batau highlighted that he incorporates old systems with new methods to experiment, learns lessons through trial and error, and determines what works best for him. In his words:

> I learned that there is an enormous difference where I put Mmutela and fertiliser. In my 11 years of farming, I have done many experiments on the two, and if I had to be honest with you, I would move to the ground manure for the entire system. Currently, I am using Mmutela instead of chemicals on 80 per cent of my farm. That is why you will rarely find the kind of spinach that looks like mine in this area.

Batau further stated:

> Unlike fertilisers, I use cow dung for two reasons; it helps to make the soil fertile, and it helps with the holding capacity of water. Because the chemicals we use, and fertilisers are not different from a person dependent on tablets. What I have learned is that fertilisers work best, but they are like a person dependent on tablets to stay alive. They are too quick to produce results but become ineffective once they get used to the soil, and then they destroy the soil.

Batau indicated that he started by researching and experimenting with what he calls nitrogen spray. Through his research, he learned that older people in Mamaila used cow dung, but they did not know about the nutrients contained in the product. He highlighted that he has since discovered that cow dung is rich in nitrogen. According

to Batau, the older people scattered Mmutela everywhere; in his case, he targets its application because scattering the compost is less effective and costly:

> I do not apply it to the whole farm. I create ridges, and then I put the compost on the sides because that is where I will plant my crops. You need to put it where you will plant your crops so that the crops can absorb it. However, it is important to understand the advantages and disadvantages of everything. Mmutela is rich in nutrients like nitrogen. Once you scatter the application, it will create many weeds for you, which creates more work, and it becomes costly.

Batau's use of cow dung has led to new opportunities in the village. He pointed out that there is an emerging value chain as he gets cow dung for free from households that own cattle. According to him, households face challenges when their kraals are full of cow dung, often leading to the loss of livestock:

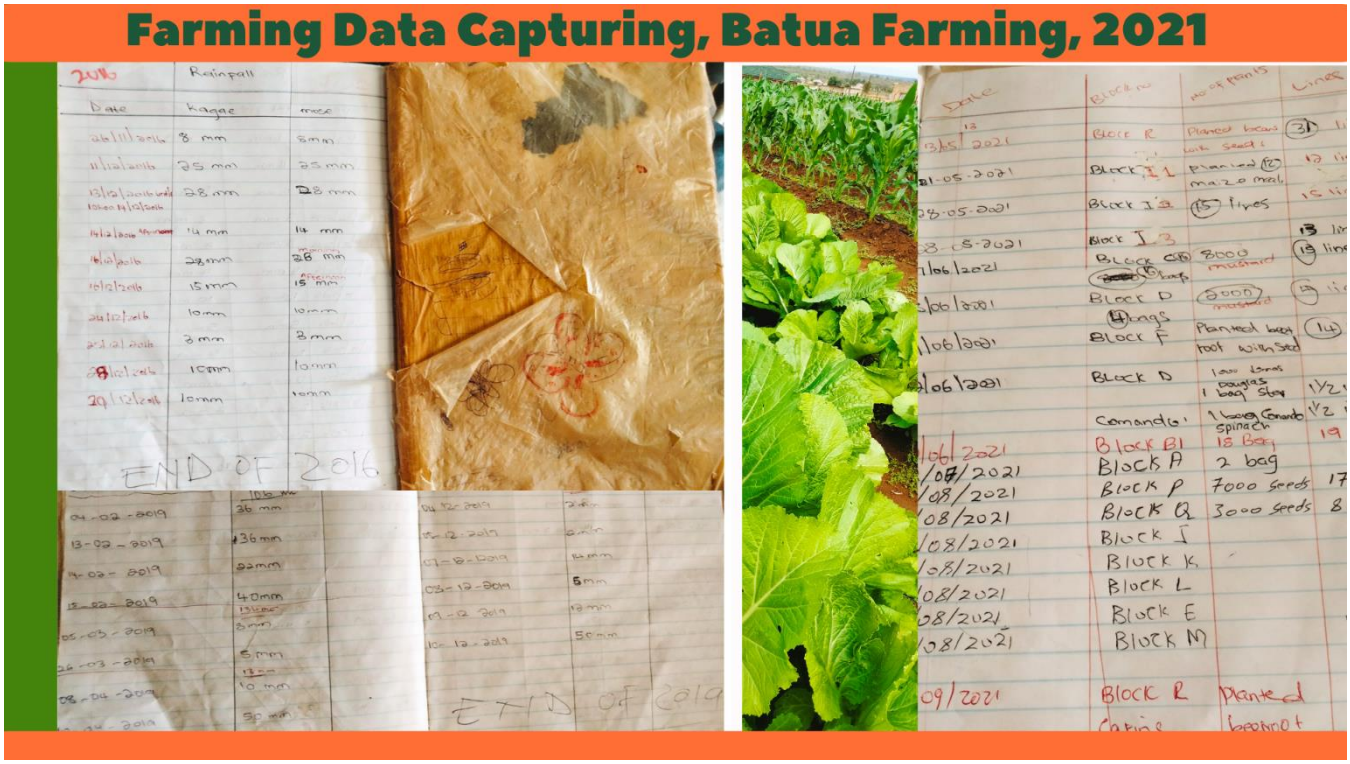
> If you come to my farm, you will see I have heaps of compost. I clean people's kraals in the village. Kraal owners call me to clean for them. They even fight for my services because too much Mmutela in the kraal affects the cows as they get trapped during the rainy seasons, causing them to lose their mobility, and once this happens, the cow must be slaughtered. I do not buy the compost. I hire people to clean the kraals and pay them for cleaning.

6.3 Inclusive digital adoption and use

Batau mentioned that he documents his day-to-day farming practices, including recording the daily weather monitoring as part of his business improvement and total quality management strategy. Although Batau has a laptop, he prefers manual data-capturing processes because he does not always have the time to capture the information directly on his laptop. Figure 6.2 illustrates the books he uses to capture data.

> Currently, I do my documentation and record keeping manually. I have a laptop, but time is always a challenge. Together with my employees, we have books for spraying, planting, fertilisation, and harvesting to capture everything. I can even tell you how much rain fell on 10 December because we recorded the rain gauge.

Figure 6-2: Daily data capturing at Batau Farming



Note: This figure illustrates the daily data captured by Batau and his employees. Source: Author, 2024.

Batau pointed out that daily weather monitoring and documentation help to measure and evaluate the impact on farming yields and inform farming decision-making. Moreover, the documented data enables him to perform data analytics as far back as 2017 as part of what he refers to as the global gap, which is used as part of total quality management and ethical farming. The quote below provides insights on why Batau documents his farming activities.

> I document my work. I just do not wake up and say I am planting. I have a plan, a yearly plan of what to plant. I plan what I want to do. I have a diary. I write. I also have something I do called the global gap. It is one thing that forces us to have record keeping because the global gap has something called traceability. If you send your spinach to a retailer and people buy it, but the store gets complaints about your product, there must be traceability of what you have done on the spinach, what you sprayed and the quantity, how long you sprayed, and when you harvested. If you do not have this kind of traceability, you can be sued for a lot of money because a person can claim that they are sick because of your products, and you do not have a record to show what you have applied to the plants or crops.

Furthermore, he pointed out that weather recording is important because knowing what and when to plant becomes challenging if one does not understand the weather patterns. Moreover, sometimes,

> we go on traceability that says in the past five years during this period on this day and time this is how the weather was like. For example, I am one of the best spinach producers in our region because everybody went on festive holidays without planting. I planted it based on my experience of knowing that people will not have money to buy

> meat in January, so they will eat more morogo. So, the business is booming right now. It is busy. People are buying a lot of spinach now in January.

Figure 6.3 illustrates some of the crop yields produced by Batau using locally produced fertiliser.

Figure 6-3: Crop yields from Batau



Note: This figure illustrates the various crop yields produced by Batau using dry cow dung (Mmutela). Source: Author, 2024.

6.4 Digital skills

Due to limited resources, the proposed conceptual prototype for exploring digital skills in agriculture could not be implemented. Consequently, I was not able to experiment with the digital skills dimension. However, Batau highlighted that he relies on learning through trial and error, using online platforms like YouTube for agricultural knowledge. According to him, “the Internet is not something people must only use for WhatsApp and Facebook. They must use it to research, know what we are doing and keep learning.” In addition, he pointed out that he attends training and workshops. In particular, he emphasised that a programme that he attended in 2017 in Nigeria stood out for him: “I met a farmer who educated me about the value chain. How he used bananas to create five different products.” He highlighted that he engages in peer learning, knowledge sharing, and exchange. However, some local farmers prefer to observe from a distance and attempt to apply the Mmutela methods independently without actively seeking assistance: “not many people come to me to learn, but as I said, all our local farmers do want this information, but their spirit of inferiority and negativity, they keep quiet, they do not ask. Some go and try for themselves. Some win, and others fail.”

Batau emphasised that farmers outside the village are more open to learning from him through his radio slot on one

of the regional stations. Some people who learn from him are well-established farmers.

> Like even our brother ZZ2, I had two lessons with him about Mmutela. He is currently using it. Moreover, because he is more advanced and has the resources and experience, he is doing it better than me. When I last visited him, I saw he sifts the compost and uses it lightly because he is trying to cut costs. He does not apply it by hand like us. He put it in the tractor and applied it on the targeted ridges.

Batau noted that while most farmers in MTA do not come to him to learn, recently, one farmer approached him. The farmer wanted to learn about it because he has cattle.

6.5 Digital infrastructure

This theme explored the appropriate digital infrastructure in facilitating localised solutions to support or enable farming. Respondent Mpho and Malekutu shared that infrastructure within the farming ecosystem should incorporate the values of Ubu-NTU: “Our culture has always been about sharing. So, the models should incorporate the sharing aspect. Ubu-NTU has a role to play.” Mpho further highlighted that recycling is part of infrastructure as “people can use waste material and transform it into infrastructure. The infrastructure that will be used for them to grow their food.” Regarding farming, Mpho highlighted that localised digital solutions include working with locally available materials and, for example, using available waste material to make vertical gardens and incorporating cow dung to create agriculture-related solutions.

Malekutu pointed out that one of the strategies to manage the cost of digital infrastructure is to consider the sharing economy: “one dimension of the sharing economy is a move away from ownership to access.” According to Malekutu, the access-based approach will be easy for Africans

> because Africans have always had an access-oriented traditional system where you have common things that everyone has access to without owning them. Access vs. ownership is one dynamic of the DKE.

Malekutu further highlighted that there is both individualistic technology and communal technology. Engaging African communities that are collective in approach, with individualistic solutions can make it challenging for people to adapt. For instance, Microsoft database can only be used by one person at a time. They call them user deployed databases. Whereas Oracle and MySQL can be used by many people at the same time. “But if you go to such a community with a collective-based technology, it will add value because, in an African context, collective ownership of data or digital infrastructure aligns with African values.” According to Malekutu, installing technology or devices in individual households does not make an impact, and rural communities might not want to adapt to individualistic technologies.

> So, what I am referring to is that data collected by technology becomes more valuable when collected and analyzed at a communal level. The collected data is called big data, and this is what big companies like Google and Facebook are called big data companies because they collect data and use it to make decisions. If they have data for one person, it does not make sense to them that the more data they have, the more valuable.

The respondents indicated that local data centres created using low-cost devices such as Raspberry PI could

facilitate collective data ownership that helps the community to solve common farming problems such as pest control.

> Instead of owning a computer, we can now access computers in the DKE. This approach will be easy for Africans because Africans have always had an access-oriented traditional system where you have common things that everyone has access to them without owning. (Malekutu)

Respondent Molemi, shared his practical insights as one of the people who identified opportunities for farmers and technologists to collaborate, as he puts it:

> In my experience, coming from a technical background, I initiated a community network project about a year ago. My point of entry was identifying opportunities to utilise technology, particularly TV White Space (TVWS), to address the crucial issue of connecting the unconnected. While platforms like YouTube for learning are beneficial, I realised that the true transformative potential lies in sectors like agriculture. Access to TVWS opens up new possibilities in agriculture, enabling innovative applications and solutions. (Molemi)

The respondents regarded farm management systems as a way of giving science to the farmers to make decisions and to enable them to predict the near future and avoid doing guesswork. Farm management software such as Farm Bids enables farm management, which could be integrated with machine learning technology, artificial intelligence and cloud computing tools.

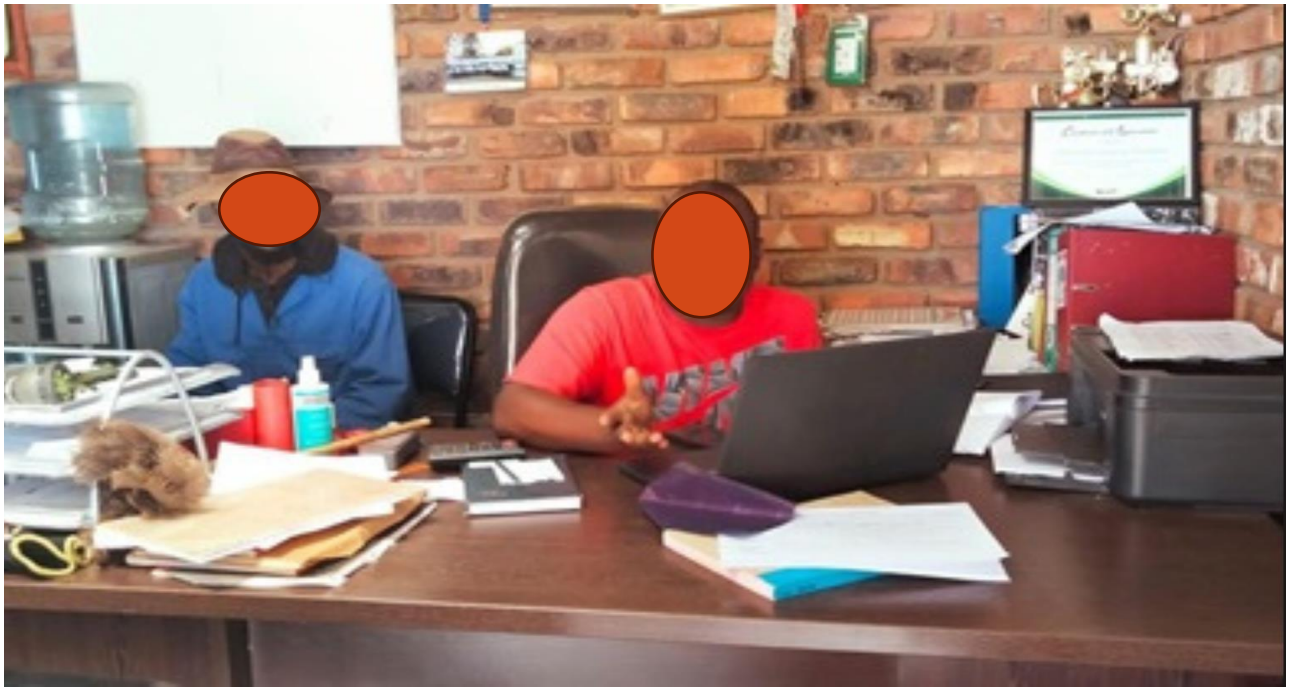
> By using data, artificial intelligence, and machine learning, we can do more with less and make money by transforming the pilot and knowledge gained from his farm as a model that could be replicated. The more data you have the more the accuracy of the model to predict. More people use and more people benefit from it and more money we generate. Therefore, it is a good ecosystem. (Molemi)

In the context of Batau farming, he pointed out that he did not use any agri-tech solutions. However, he would like to use hydroponics as this will enable him to control the farming activities throughout the year. Currently, he feels limited by the weather conditions because he can only plant crops according to the seasons of the year. He would like to plant certain crops throughout the year, and he can only do this if he can use the hydroponics solution. He sees hydroponics as an innovative solution that can help him to expand and increase his profit margin.

> Technology-wise, I am currently using a dripping watering system in my farm. The technology that I want is tunnels or hydroponics. This will work for me. It will help me in a big way because it will increase my profit in a big way. (Batau)

Moreover, Batau demonstrated that he owns a laptop illustrated in Figure 6.4, although he does not use it often due to time constraints as he puts it; “currently, I do my documentation and record keeping manually I have a laptop, but time is always a challenge. Together with my employees we have books for spraying, planting, fertilisation, harvesting to capture everything.”

Figure 6-4: Batau's office in MTA and one of the employees who assist him with data capturing

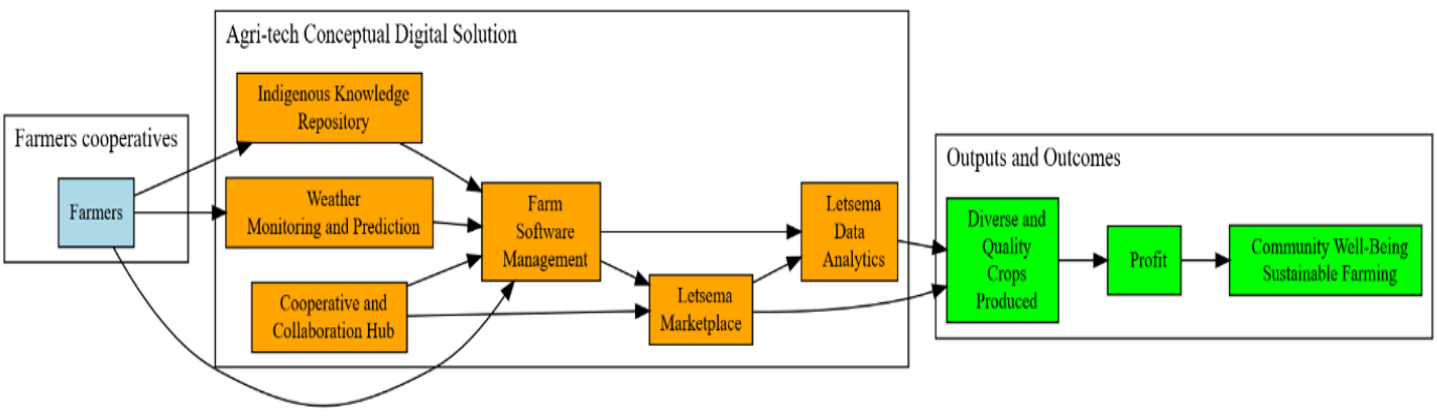


Note: This figure illustrates the digital devices used by Batua in managing his farm, including the books he uses to manually capture and analyse data.

6.5.1 Conceptual agri-tech solution

Due to resource constraints and limitations, I did not develop the agritech prototype. Figure 6.5 is a conceptual agri-tech solution as a potential digital solution based on the insights gained from the respondents illustrating a comprehensive framework for integrating digital solutions into the farming cooperative value chain.

Figure 6-5: Conceptual digital solutions in the farming cooperative value chain



Note: This figure illustrates the conceptual value chain depicting the integration of agri-tech solutions in a cooperative of farmers. Source: Author, 2024.

The conceptual digital solution is composed of the following modules or functionalities:

1 **Knowledge-sharing:** the solution could serve as a platform for sharing and disseminating indigenous agricultural knowledge among cooperative members to promote best practices, such as the use of Mmutela fertiliser.
2 **Weather monitoring:** could provide real-time weather data and forecasts to assist with informed decision-making for farming activities.
3 The **Letšema marketplace:** could connect farmers to potential customers, facilitating the sale of agricultural products.
4 The **Cooperative Collaboration Hub:** could facilitate collaboration and cooperation between farmers in the agri-tech solution to address individual farmers' challenges, to empower them through collective action, and to manage the challenges identified by Batau.
5 **Farm software management:** could manage the end-to-end process, integrating AI, machine learning, and precision farming.
6 **Letšema data analytics:** could analyse data generated by farming activities, enabling data-driven decision-making.
7 **Outputs, profit, and outcomes:** the outputs, profit, and outcomes could be the results of the interactions initiated by the famers and are facilitated by the conceptual digital solution.

6.6 Digital leadership

This theme aimed to explore leadership perspectives relevant to the farming case study. The macro and meso respondents highlighted that farmers could use Ubu-NTU to tap into agricultural capabilities by developing digital applications that facilitate bartering and collective data centres. In contrast, the micro level perspective from Batau is that Ubu-NTU faces challenges in Mamaila. Specifically, he emphasised that farmers in Mamaila encounter difficulties in collaborating and maintaining unity due to factors such as jealousy and a lack of trust, which hinder their ability to share knowledge and combine resources effectively:

> I am speaking from experience. Many farmers are killing the industry. The lessons that I learnt from ZZ2 indicate that he mastered specialisation by focusing on tomatoes and working with other farmers who specialised in farming cabbage. Black farmers compete and produce the same crops. Ultimately, we end up with an oversupply and flood the market. When we go to retailers, they play around with us regarding price negotiations. Farmers end up lowering their prices to secure a deal from the retailer. The over-flooding of the market means that you are dropping the price. At the same time, the retailers do not drop their prices. They get the product cheaper and sell it at a good price, making profit. However, if we, the farmers could be united and collectively agree on a standard price, people would not have options.

According to Batau:

Farmers can grow their market together if they collaborate instead of competing for the same market. They could actively engage in product outsourcing from one another, implementing the principles of the sharing economy.

Collaboration and outsourcing could enable them to add markups and prevent overproduction, ultimately preventing customers from getting stuck with surplus products. Batau highlighted that he used the outsourcing strategy when he started his farming enterprise as he could not deliver the quantities required by the retailers. Batau started with outsourcing when a farmer who used to supply the retailer with cabbage failed to deliver, and the retailer asked him to deliver. At this point, he was mainly producing spinach.

> One of my advantages was that the retailer I was delivering to was also the owner of the Tzaneen and Giyani supermarkets. Automatically, I did not market to those shops. Because my product was quality, the owner automatically wanted me to deliver to those shops.

Batau emphasised that, in many cases, local farmers struggle to secure contracts and are often exploited by retailers who take advantage of the flooded market. During COVID-19, the cost of farming inputs such as seedlings increased, making it difficult for farmers to profit. This challenge brought the farmers in Mamaila together to strategise on how to deal with the issue by establishing a forum that could have grown into cooperation. Farmers resolved to increase the price of spinach from R10 to R15. He stated:

> I experimented with the farmers here at Mamaila because […] I thought we could do it just like taxis do because our prices, like the taxis, take too long before we increase. We had a meeting and agreed on the increase. Later, a few people realised that they were not getting customers. They decreased the price back to R10 without consulting with the collective […]. The situation created conflict, and it affected the cooperation

Leaders in both the political and administrative spheres do not understand the real needs of the farmers (digital and non-digital). They participate in the farming sector without a clear picture/understanding of what farmers go through daily. Regarding meso and macro level leadership, Batau highlighted that

> the role of leadership is very simple. They must come to the ground. I have organised three farmers' days and invited MECs and mayors to Limpopo. When I organise these things, I always ensure that the event does not take place under the shade because that is the reality of a farmer. If they sit in their offices there with aircon and develop policies and ways of helping the farmers, it cannot be possible, and they need to develop those policies and plans for farmers under the sun because that is where the farmer works. Leaders must come to the ground to talk about farming.

Another respondent highlighted the role of digital leadership in creating a conducive environment to leverage technologies such as TVWS to enable agri-tech and in his view, this is where the role of leadership is needed. As he puts it:

> It is more for us to deal with the regulation environment. And this is where leadership comes in and this is where they must make sure that they manage the resources in a way that promotes justice because currently, they are prioritising the resources to big Telkos just to get money without thinking about the social benefits. They approach it as a capital matter, there is no consideration of how to use the resource to help the community to grow based on that.

Respondent Malekutu indicated a need for servant and steward-based leadership in facilitating DT.

> Servant and steward-based leadership allows those who lead DT and agricultural processes to focus on the beneficiaries. It removes the actors from the centre and creates an environment for learning and knowledge exchange by allowing all role players to find expression. (Malekutu)

In the African context of leadership, Mpho emphasised the importance of acknowledging that we are all leaders: we are all leaders and the same applies to digital leadership.

> We simply play different roles, and each role involves leadership. There is a tendency for people to relinquish their power, which hinders our ability to innovate or initiate solutions. Instead, we often wait for someone else to take the lead. Avoiding this concept of leadership can lead to an inferiority complex, making us feel unworthy and obscuring our recognition of our own capabilities.

6.7 Highlights from the agri-tech case study

Although the study did not develop a prototype solution for agri-tech, the digital aspirations expressed by farmers provided insights for developing the conceptual solution. The farming case study reveals the potential for farmers in resource-constrained environments to adopt and use technologies to improve business processes, increase profit margins, and manage resources more efficiently. It demonstrates that integrating traditional and modern knowledge systems can contribute to creating communal value chains through cooperative approaches like Letšema. Furthermore, Letšema collective capabilities have the potential to develop a local marketplace connecting farmers with buyers and facilitating the exchange of agricultural products. The competitive environment, however, hinders the leveraging of Letšema collective capabilities, necessitating ongoing change management efforts for a shift towards more collaborative approaches. The case study further reveals that there is an interconnectedness between financial and farming systems, which both depend on intergenerational knowledge transfer and learning by doing.

In the next chapter, I present the findings from the macro and meso-level perspectives, drawing from interviews with respondents and the analysis of government policy documents. The macro-level findings explore the influence of national policies, regulatory frameworks, and government strategies on digital transformation (DT). The meso-level findings focus on the roles of intermediaries, such as community organisations, policy/research intermediaries, and digital entrepreneurs. Together, these findings illustrate how national and regional policies, along with the actions of intermediaries, shape micro-level practices and interventions, offering a holistic understanding of the broader policy landscape's impact on digital transformation in resource-constrained environments..

CHAPTER 7 :MACRO- AND MESO-LEVEL PERSPECTIVES ON CULTURALLY EMBEDDED DT

7.1 Introduction

The chapter is organised according to the research analytical framework, starting with the cultural practices and processes dimension. followed by inclusive digital usage and adoption, digital skills, digital infrastructure, and digital leadership. In this chapter, I present the findings from interviews conducted with macro and meso respondents as well as document analyses focusing on government policies, strategies, and regulatory interventions. The respondents included a representative of the House of Traditional Leaders in South Africa, farmers, digital entrepreneurs, ICT4D practitioners, and policy regulators.

7.2 Cultural knowledge systems, practices, and processes

In this section, I present the findings on how deeply embedded cultural practices unlock collective human capabilities for inclusive digital adoption and usage. The presentation is organised according to the themes emerging from the data analysis: cultural framework, identity and spirituality, systems, practices and processes, and knowledge transmission. The respondents shared that culture is a commonly owned framework in a community. The framework incorporates unchanging traditions like norms, values, taboos, and protocols that foster unity and a sense of belonging in the community. In addition, culture represents the way of life for people with common ancestry, ethnic backgrounds, or shared language heritage, and historical events form part of the cultural framework. Mokhobi points out that culture manifests through behavioural codes, interpersonal relationships, and non-negotiable customs. For instance, respondent Matome explained culture as a commonly owned framework, as captured in the quote below:

> Culture is the lifestyle of the people in a specific area, and I want to emphasise that the lifestyle is agreed upon communally by that community. It is a commonly owned framework. In other words, a given people agree on the rules, standards, and quality of the things they will do as part of that community.

According to Matome, the cultural framework and the way of life reflect the sovereignty of the people and their community. Furthermore, the community embeds its laws in its unwritten constitution. Matome emphasised that if the cultural framework (the unwritten constitution and the country's written constitution) does not align with people's ways of living, it will lead to injustice, creating a dichotomy between the people and the constitution. Additionally, respondents emphasised that traditions remain constant while culture evolves as a dynamic framework transmitted from generation to generation. Furthermore, a cultural framework goes through processes of authentication and must meet specific criteria that do not detach it from the community's traditions. In contrast to the majority views, respondent Morepiwa pointed out that culture is not static, and there is no such thing as African culture because culture is dynamic and evolving. According to Morepiwa, the dynamic nature of culture

> is also about taking the culture and re-appropriating it in the light of current values. People did many things in the past that might have been appropriate 100 years ago, that are part of the culture but are no longer necessarily part of the culture. Culture needs to grow and adapt, strengthen the richness and the valuable things, so we continually

> expropriate, re-invent, and re-imagine culture, economy, and societal changes.

Morepiwa pointed out that adhering rigidly to practices that are not relevant in today's era will destroy the culture, emphasising that it is crucial to keep the valuable things. In the words of respondent Thando, people must express themselves culturally without expecting them to approach cultural expressions such as: "We are still in the 1800s. Therefore, it is crucial to understand that culture adapts with time much like innovation."

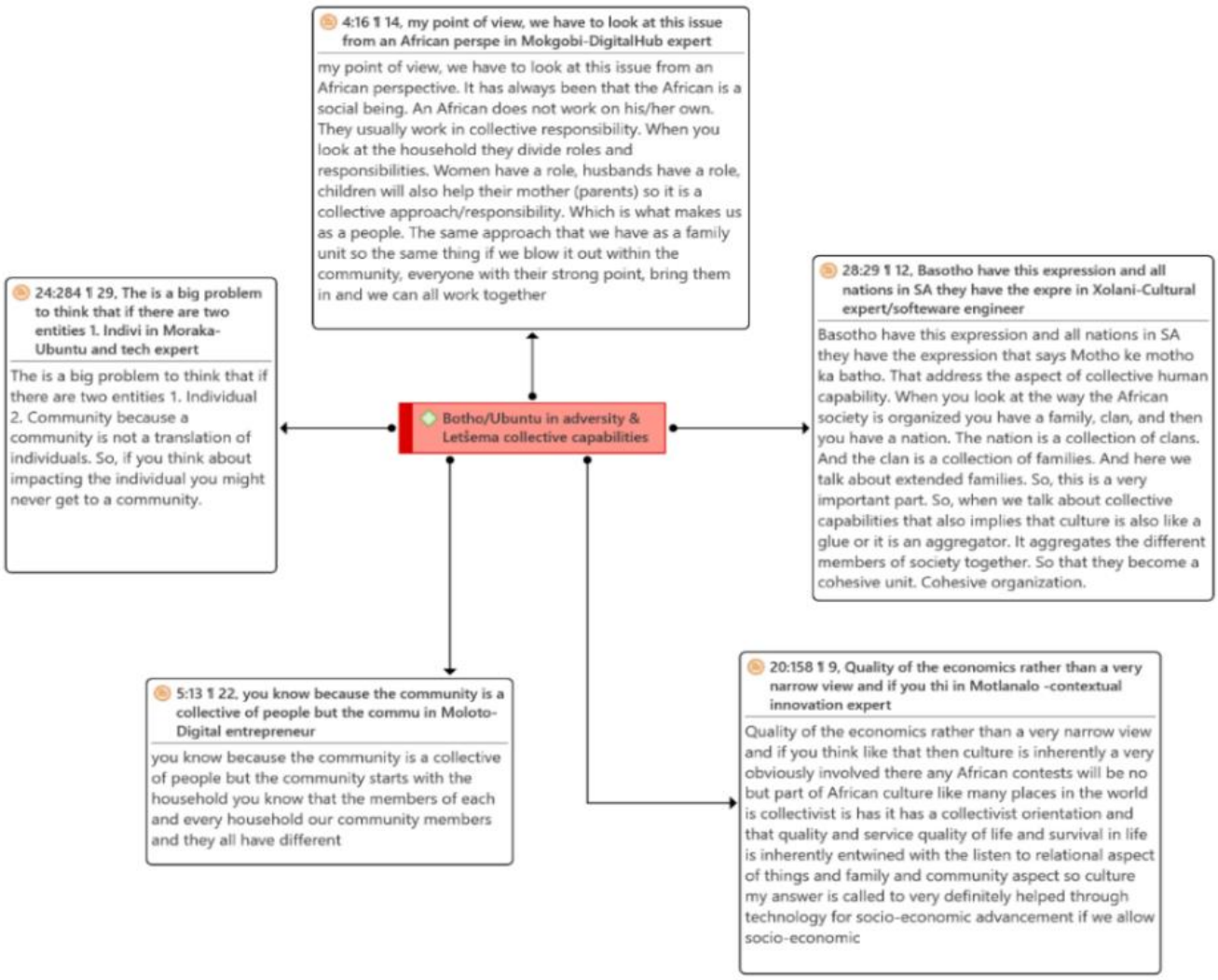
The respondents shared their unique perspectives on the significance of cultural frameworks in shaping community identity and the collective capabilities of the communities. Respondent Xolani provided insights into the structural aspects of African society, emphasising the roles of the family, clan, and nation, and how culture acts as a cohesive force that binds people together. Respondent Malekutu highlighted the belief in African culture that places the community and extended families above individual interests, exemplified by the proverb "Motho ke motho ka Batho ba bangwe" ("I am because we are"). Meanwhile, respondent Matome pointed out that the individual's influence within the cultural framework is limited, as culture is a governance structure collectively agreed upon, and it cannot be unilaterally devised by an individual. According to Matome, "the individual cannot just devise a way of living and declare it a culture". Furthermore, Matome stated that if individual acts are perceived as not aligning with communal values and spirit, such an individual will become isolated. Respondent Moroka supported Matome's perspective by highlighting that a community's identity differs from an individual's identity, and any community intervention should aim to impact the collective rather than the individual. Matome further described the role of marriage as a cultural practice that serves as an asset for the community in which the marriage of two people is an organ of a community.

Respondent Motlanalo highlighted the importance of communal welfare and the sense of identity in African families and communities. According to Motlanalo, the quality of life, survival, and relational aspects in African families and communities are interconnected: "the well-being of individuals in African societies is intricately linked with the collective welfare of their families and communities". Furthermore, the respondents stated that from the perspective of capabilities and social capital, African communities have historically relied on collective efforts for exchanging goods, services, and labour, as shown in Figure 7.1. For instance, in Xolani's words,

> when you look at how African society is organised, you have a family, clan, and nation. The nation is a collection of clans. Furthermore, the clan is a collection of families. Here, we talk about extended families. So, this is a very important part. So, talking about collective capabilities implies that culture is also like a glue or an aggregator. It aggregates the different members of society together. So that they become a cohesive unit and organisation.

According to Xolani, the proverb "Motho ke motho ka Batho" unlocks collective capabilities. In addition, the respondents pointed out that the individual, family, clan, and community shape the collective capabilities in the cultural framework. Furthermore, several respondents stated that Africans value the contributions of all community members in collective work, including children.

Figure 7-1: Respondents' views on collective work and capabilities



Note: The Atlas.ti figure captures the views expressed on the role of the African social structure in collective actions and well-being.

7.2.2 Worldviews and belief systems

Another theme observed in the data is the differences in worldviews between African metaphysical concepts and those prevalent in Western societies. According to some respondents, in certain African societies, ancestors are believed to possess agency and maintain an ongoing presence. For instance, the respondents explained that the process of naming children operates as a systematic practice. Some names are associated with a specific family narrative, one's role in the family, or significant life events. For example, Mokhadi shared that her name is Oliwafu, meaning "God has given me joy" because after her mother married, she struggled to conceive for two years. Furthermore, Mokhadi indicated that the naming system was lost due to Christianity:

> Now people became Christian; they removed the Oracle name and put the name of God by saying God has done this instead of the Oracle doing it. Which is something their grandfathers believed in. So, many people have replaced the Oracle because of Christianity. Traditional Oracle, which has brought them to life. They would rather say it is God, the Christian God, but the Oracle and the Christian God are the same. But people do not see it that

way.

Furthermore, the respondents described the African worldview as consisting of different layers of reality. These layers include perceptual reality, which involves spirituality and is not visible, and symbolic reality, which encompasses activities like dance, singing, and drum playing. For example, Xolani explained that in an African context, the act of wearing beads or bracelets is not just an aesthetic choice, but also carries symbolism linked to one's spirituality, community status, and life events. Xolani further pointed out another tangible expression of spirituality in the form of the nkgo (clay pot), which represents a manifestation of the spirit in the intra-active reality, as illustrated in Figure 7.2. In addition, Zolani highlighted that wind is spirit (moya): "You cannot observe the wind, but you can interact with the manifestation of moya." The respondents further highlighted the link between practices, processes, and events. For example, Mokhadi pointed out that traditional festivals in her hometown are connected to the farming season, and often, during that period, women cannot come out, and they cannot use beans to cook anything in preparing for that festival.

Figure 7-2: The African clay pot exemplifies intra-active reality, while Maseka represents symbolic reality



Note: Nkgo with traditional beer and Maseka African bracelets displayed during the action-research digital prototype testing workshop.

Thando highlighted that some rituals link to practices such as rainmaking processes:

> I also want to add that who performs these rituals in an African society is crucial. You might find that in a certain culture, maybe people who pray for the rain are still under the age of 13 and maybe they are still virgins. In other instances, you might have to wait until they have experienced their menstrual cycle.

Respondent Mokhobi sheds light on perspectives relating to birth rituals:

> If twins are born, people perform some rituals to show that this birth is not like a normal birth. It is seen as something special in the clan. That is why the names of the twins are also different from the names of single-born children. The elders perform rituals and praise the Gods of the land for giving twins.

In addition, Mokhobi shared a practical example of the intersection between spirituality and community development in the context of ICT4D:

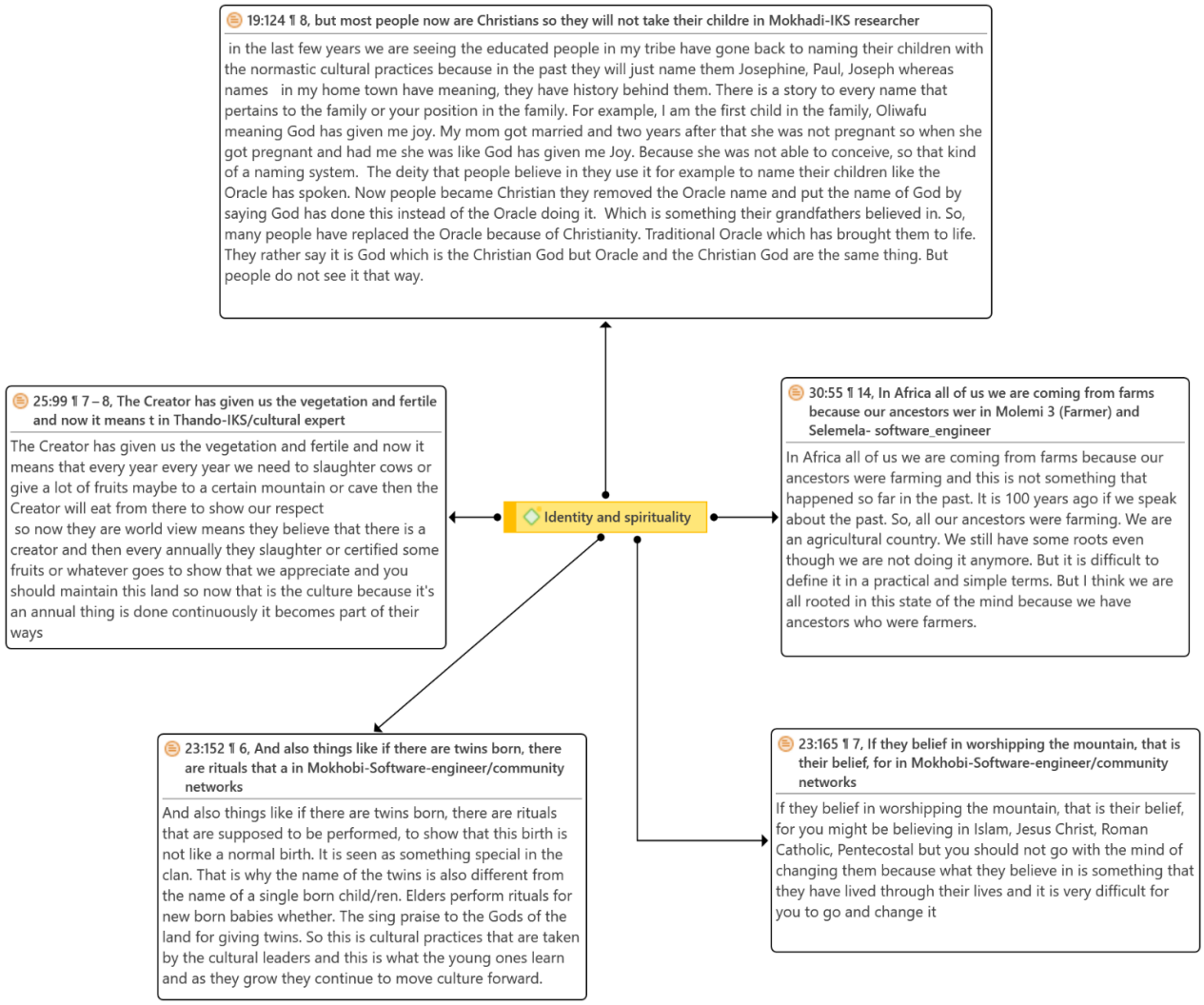
> We found a very strategic hill for the construction of our tower, but the community there in the meeting said before you start with any construction, we need to do rituals in this mountain for you to be successful.

In his words:

> It was essential to listen to the community because they have been there. They have experience, they know what it takes, it may disturb an idol hill, or sometimes they do rituals. They believe in the gods of that area. There is some supernatural being that manages that hill. We had to concur with them and slaughter like a goat on the mountain before laying the foundation for the construction work. The consultation made the villagers to cooperate during construction.

Furthermore, the respondents highlighted that the systems are culturally, politically, and socially rooted in spirituality, as shown in Figure 7.3. The respondents pointed out the link between the living and the ancestors, highlighting that the naming of the children forms part of their identity and a connection to the past.

Figure 7-3: Respondents' views on identity and spirituality



Note: The Atlas.ti figure captures the views expressed on identity and spirituality.

The respondents emphasised that knowledge systems encompass diverse categories such as music, rituals, land, spirituality, farming, art, dancing, environment, health, economic systems, education, entertainment, moral regeneration, politics, and cosmology. The prior generations, according to the respondents, developed the systems, practices, and processes through trial and error as part of the cultural framework. In the words of Motlanalo:

> In the context of the Kalahari region, where a community of San people resides, their cultural knowledge system, and their observational skills, they can discern between different plants and animals in their environment. This knowledge is shared verbally among community members and is passed down through generations. It is worth mentioning that their approach contrasts markedly with the scientific worldview.

The respondents emphasised that the practices and processes of a group are closely interconnected with the systems they use. Consequently, external observers may encounter some elements that are difficult to access or understand. In the words of Xolani: "You cannot access the inside of the systems because it is like a black box. Only externally can one interact with it and get a sense through touching or watching." For example, respondent Thando highlighted that sometimes the community might believe that there is a deity responsible for rainfall, or a deity associated with the sun. As a result, specific individuals conduct rituals related to the deities, and there are prohibitions linked to cultural practices in every culture and society. Matome highlighted that the systems, practices, and processes are not detached from the cultural framework as they flow from the cultural design of the community.

Furthermore, the respondents emphasised that the practices, processes, and knowledge systems are not integrated into discussions on digitisation and digitalisation. As Moroka pointed out:

> The discussions involve different languages […] the challenge lies in the need to explain language B (community language) in terms of language A (scientific language). In addition, the explanation process requires translation, but it is never perfect. For instance, what does DT mean for communities? What impact does digitisation have?

In contrast to the exclusion perspectives, some respondents highlighted that there is an increasing consideration of African knowledge systems in global knowledge production. For example, respondent Mokhadi pointed out that some universities use Ubu-NTU and Sankofa theories. According to Mokhadi, African knowledge systems must meet the global standards of knowledge production, and African scholars need to make valuable contributions that align with global standards of knowledge production. In her words:

> Africans are part of the world. Ubu-NTU has become a global thing. Academics have built on this to build a theory. So, we cannot isolate ourselves from the world. Even Sankofa, a Ghanaian proverb, is now a global theory. Whatever scholarship produces must be good enough to be added to the global knowledge system. Even Western universities now include African studies and are open to viewing Africa with a different lens instead of the monolithic lens.

Respondent Thando highlighted the shift from an era when African scholars were not actively engaged in knowledge production. According to Thando, "digitisation provides African scholars with platforms to narrate their stories and reclaim their history, produce knowledge and learn about the various African knowledge systems". Moreover, digitising knowledge has eliminated the gatekeeping regarding the availability of knowledge, and how

it is processed. According to Thando, African people are now studying African Studies and languages: “These African scholars are saying, let us use our knowledge systems to benefit our people.” In addition to reclaiming African philosophies, respondent Mpho highlighted that indigenous knowledge systems are being revived in the agricultural value chain as part of the mitigation strategies in climate change.

7.3 Inclusive digital adoption and use

In this section, I present the findings on how cultural knowledge systems, practices and processes (CKSPPs) facilitate communities’ adoption and use of technology in resource-constrained environments in the digital era. The presentation follows the themes emerging from the data analysis: the exclusion of African CKSPPs s from digital technologies, African technologies and innovations, localisation, and community aspirations.

The exclusion of CKSPPs from digital technologies is one of the themes that emerged from the data analysis. The respondents shared their concerns about embracing digital technologies while remaining cautious of potential biases and exclusions in the tools and datasets. Respondent Moroka pointed out that ICT4D as part of digitalisation is designed in the West and based on specific ways of thinking. In Moroka’s words: “the West decides what is important and not important. In many cases, what Africans or communities view as necessary is often excluded. For example, Africans value ancestry, but this is never part of the digitisation discourses.” In addition, Moroka highlighted that the digital products and services available for Africans to use are from the West and embody Western choices: “The question is, what does digitisation throw away? The community might not recognise digitisation as doing something the same way that the Eurocentric view thinks it does. So, you make a thing, you separate it.”

Similarly, respondent Xolani emphasised the need to align technology with African contexts and challenges, highlighting that technology reflects the values and principles of the designers and developers.

> Technology is a cultural artefact of the people who paid for it. Right now, the way technology is developed is based on European values and principles. It does not fit hand and glove with the African context. So, we will need African engineers to design systems intended to solve African problems.

Respondent Selemela stated that there is a disconnect between technology and cultural approaches. For example, the introduction of technology in agriculture often excludes discussions about legacy approaches and traditions, suggesting a lack of integration between the two:

> The problem is that we do not link this [technology] approach with our roots in terms of our cultural knowledge systems. We even try to exclude it. We consider all these legacy things not to be good. When introducing technology in agriculture, we avoid discussing the legacy approach because we think technology means excluding legacy and traditions.

Furthermore, the respondents expressed concerns about language and data representation in technology development. The respondents emphasised the importance of incorporating multilingual data and natural language processing in digital technologies and applications. Furthermore, they highlighted the potential erosion of African

identities through the adoption of Western lifestyles via technology. For instance, respondent Matome highlighted that introducing technology in African contexts disrupts African ways of living. According to Matome, "the first intention is to serve the agenda of the people who introduce technology, treating Africans as consumers and assimilating them to their cultures or worldviews". Matome emphasised that, on the other hand, technology as a tool is not a problem because Africans use technology to advance their ways of living. According to Matome, Africans can reverse the situation and apply "reverse engineering":

> How do we turn the tables for technology to work for us? We need to stand back and begin to employ reverse engineering. So, we then draw lessons from these new technologies and begin to make them fit into our circumstances by first and foremost saying that our thinking, dreaming, and speaking is an African approach to issues. How do we then take these technologies to fit our formula for doing things?

Matome emphasised the need for reverse engineering to avoid a situation where Africans will forever be trapped if they do not adopt such an approach. Moreover, Matome emphasised that consumerism is not only located in technology but across the value chain of economics and the finance system: "There is nothing wrong with technology, but technology must not colonise us; instead, we must take technology and use it to advance that which is African in terms of approach in that way; then it becomes a winning formula." In addition, Matome pointed out that "when you consume, you will consume in perpetuity. You will forever be excited about the iPhone 1 2 3 4. So, we need to change the narrative."

The respondents noted that, historically, African communities were skilled in creating and employing technological instruments tailored for specific purposes. The respondents explained that technology is a tool that enables a person or group of people to perform tasks in a simplified and efficient manner. Historically, African ancestors developed tools for communicating, making fire, creating weapons, making clothing from animal skins, farming, smelting iron into different shapes, and making stools, tables, and chairs, among other things. At the same time, another respondent indicated that when people think about African technology, they think of witchcraft, even when there is historical evidence of the existence of African technology. The respondents pointed out that Africans' historical engineering and technological capabilities are traceable from the languages. For example, respondent Xolani indicated that technology is an artefact of design produced by the engineering process. In the Basotho context, women played a crucial role in preserving design and engineering knowledge, encapsulated by the term Morwêdi. As Xolani stated: "In Sesotho, design is called Moralo, and women were the custodians of Moralo. Design is the knowledge that was always curated by women, to the extent that Moradi means a designer referring to a daughter (Morwêdi)".

Respondent Mokhadi expressed similar sentiments, highlighting that technology is not new for Africans, as Africans have always created tools to solve their problems. According to Mokhadi, her clan praise song captures the skills of her ancestors:

> For example, I come from a clan where our people were blacksmiths. They made tools for farming, decorations made of brass and gold, et cetera. They were known to be rich because of that technology. Their ability to design, which is captured in their clan's name (praise names), captures the things they did, their richness, their way of

> living and their loving, nurturing character. So, if we talk about the word technology, that is not our word, but that does not mean that we did not have a way of creating and designing. There were processes that people used to make things and to make things work.

The respondents highlighted that technology is a tool that should help people solve problems by aligning with their aspirations, specific needs, and context rather than imposing preconceived solutions. Respondent Modjadji pointed out that "the problem is that those working in DT are focusing on what they want to achieve, yet if they went to the community, they would get a lot". Modjadji also emphasised the need for technology to fit the cultural context and community needs rather than forcing individuals to adapt to technology: "We must look at what people are doing and what works for them to make the technology fit in, not them fitting into it. [If we do not] it will not work because they will return to ways that work for them." Moloto shared that the individuality or uniqueness of cultures needs to be appreciated because not everything from the West is good for Africans:

> For example, we have Amazon, which has just launched an automated supermarket. You just walk into the supermarket, and as you walk out, you just get billed, and your phone is charged. So, there is no interaction between the customer and the cashier. But is that necessarily correct? Is that necessarily correct on the African continent? A lot of us depend on daily interaction. With that kind of automation, will it build or bring us down?

Moloto highlighted the importance of learning from the West and the need for localisation instead of copy and paste: "We can take the good things from that. That is where we need the intellectuals. We look at how it has been applied and localise it to our situation." Modjadji elaborated on why technology fails: "It could be that we just copy and paste. This could be one of our problems. Because we are just copying and pasting."

According to Modjadji, some people read about the use of e-commerce in America and then decide to bring it to Africa when the community wants to understand the Internet and why they should subscribe to it. Furthermore, she highlighted a lack of understanding of the community's needs:

> For example, selling online is none of their priorities. It is a priority for Europe because they have all the resources. So, it is not a priority in my village, so why am I telling them about e-commerce when they first want to see or learn how to use the Internet?

According to Malekutu, locally generated data can provide valuable insights for informed decision-making when collected and analysed at a communal level, a concept known as big data analytics:

> The data will be more valuable when collected and analysed at a communal level. It is called big data, and therefore big companies like Google and Facebook are known as big data companies because they collect data and use it to make decisions.

Respondent Mpho, a farmer, highlighted the significance of local exchanges in promoting community self-reliance and described how individuals could swap and barter their produce to meet their dietary needs:

> Instead of using money to acquire what we need, bartering becomes the solution. In this scenario, if one person requires protein, another has a surplus. Why sell it when we can swap and barter? This entire process represents an economic

> transaction within our community.

The respondents pointed out that African youth play a role in preserving and promoting cultural heritage, highlighting the need for competencies in culture and modern technologies. For example, Mokhadi stated: "We can use technology, the Internet for digitisation of our local festivals, stories, folklore, indigenous games, mathematics to do critical thinking and all that." Mankete emphasised using cultural heritage to promote and preserve African culture globally, recognising the importance of preserving and sharing traditional stories and practices. According to Mankete:

> The West uses everything. They can preserve their mythology. Until Black Panther, Africa struggled to tell its stories in the way that Marvel could do with the right budget, which was accepted globally. We must also start excitingly preserving our culture.

Respondent Matome said:

> Why do we have to go to America to Google the clan names of Africans? Why can't we have our search engines? Where content like the clan names is stocked up in our instruments. If we were to develop a counter to Google and have a repository, a bank for content in Africa.

Moreover, the respondents highlighted the need for people to stay connected with their ancestral land. One respondent stated: "Do you think we will leave them (ancestors) because suddenly there are cities we inherited from coloniality? No!" Another respondent stated that the DKE offers multiple benefits that could result in thriving communities. Mokhobi stated that communities have their ways of doing things, both socially and economically, and so we can "just make it easier for them by using technology to communicate, send info, and buy". Moreover, it is important to engage with the community through community structures such as the tribal authority. In his words:

> The community would tell us stories about their area, how the community is, what the community are all about, what are the things that might make your project fail because they are certain things that a particular community might not like or the experiences that they have gone through, so you should not go and touch on somebody's wound. So, there are things that you should do and handle with care in the community. Some of the failures that come are because we go and throw these things. We force them to use these things without telling them how it will benefit them.

The quotes below provide more insight into the perspectives shared by respondents Malekutu and Selemela:

> DT, at its core, simply says I was doing something physical or manual. Now, I am transforming a process. Either using robots is a transformation of a previously manual process. It is not manual. (Malekutu)

> For me, if I can simply define technology, it is a tool. As a tool, we should choose the right way of using it. Choosing the right way is the basic principle […]. It means that we must first define what we do with the tool. So, when it comes to agriculture, we must define what we want to achieve with agriculture. For example, we know that we need agriculture to feed ourselves and as an economic activity because we export agricultural products. So

> everywhere, whether in a village or city, we need agriculture. We must define how we want these tools to improve our agriculture. (Selemela)

7.4 Digital skills

In this section I present the findings on how CKSPPs facilitate the development of digital skills required for active participation in the digital era. The presentation follows the themes emerging from the data analysis: intergenerational, contextual, and situated learning, learning by doing, and change management.

The respondents highlighted that learning in the African context is communal and part of social responsibility. Moroka emphasised that in an African context, individuals acquire knowledge through direct experience, rooted in gaining insights and wisdom from their experiences. The respondents highlighted the importance of recognising appropriate contexts for knowledge exchange between various groups in the community. This includes recognising situations where peer groups learn together and share insights, where elders impart wisdom to younger members, and where the younger generation contributes knowledge to their elders. Furthermore, it is crucial to know the existing ways of transferring skills and sharing knowledge.

> Communities already have methods for teaching fellow members, and it's crucial for us in the tech industry to understand this. For instance, if you visit a community, they may allocate specific times for farming, markets, and interaction, with learning often occurring during these interactions. For example, in Acholi culture, there's a tradition called Wangoo, which serves as a gathering place for transferring teachings on culture, history, and economy to children. (Mokhobi)

Motlanalo suggested that "embedding learning into everyday activities is crucial, rather than confining it to a classroom setting". Additionally, Modjadji highlighted the value of urban and rural communities exchanging knowledge:

> In my case, we travel from [town] to learn from the communities. That is how they teach us. For example, in my clan, every 28th of December, the entire clan, about 300 of us, gathers. The missing link right now is technology.

The respondents highlighted that passing down cultural knowledge from one generation to another ensures the continuity of cultural practices and systems. Mokhobi and Matome emphasised that culture and traditions are passed from generation to generation: "We have inherited our heritage from our ancestors for us to transmit to the next generation so that the next generation can inherit it for future generations" (Mokhobi).

On the other hand, Motlanalo pointed out that "understanding tradition and culture is challenging because the British introduced the headman system as part of their manipulation of pre-existing systems. They introduced headmen in all their colonies." In line with Motlanalo's view, respondent Moroka emphasised the role of history in determining what is considered valid. According to Moroka, historical narratives can diverge based on the narrator's perspective and the context: "The coloniser wrote history for certain purposes and results, which are for political results to dominate" (Moroka).

Xolani expressed a similar view, emphasising the existence of multiple realities and truths. According to Xolani, "the political or administrative truth dominates". Concerning the validity of African knowledge, Xolani highlighted that true knowledge comes from the breast.

> Tsebo ya nnete ke tsebo ya letswele gobane letswele kennete (true knowledge comes from the breast), emphasising that true knowledge is encoded in the chromosomes, passed down from generation to generation, and transferred through breastfeeding and individual experiences. The knowledge must be part of the genome. Breastfeeding symbolises this because milk is part of the chromosomes. So, knowledge must be embedded, it must be deeply embedded, and the knowledge must be embedded at a very young age.

Malekutu illustrated how traditional African knowledge and colonial knowledge production systems have contrasting frameworks:

> Teaching how lightning forms illustrates how difficult it is for African kids, possessing deep African culture in their daily lives, to learn and internalise certain scientific concepts. In physics class, we teach kids that lightning forms when negative charges (electrons) in the bottom of clouds get attracted to positive charges (protons) on the ground. However, in traditional African households, it is known that renowned traditional healers (nyangas or sangomas) create and send lightning to attack enemies.

According to Malekutu, the ways of knowing, understanding, and interpreting concepts for some African children are disconnected from the knowledge transmitted in the classroom:

> So as much as an African-cultured kid will "regurgitate" during a physics exam that lightning forms from electrons and protons to pass the exam, they will not internalise the physics and science behind lightning after the exam because deep in their hearts they are convinced lightning is created from sangomas and n'angas only. So, there is a clash or conflict of knowledge systems.

Furthermore, Moraka highlighted that epistemologies in African communities have a "collective, dynamic, and integrated" nature, contrasting with the linear structure of the Western knowledge system. In his words,

> knowledge in African communities starts to exist when people interact with it. In addition, there is a difference between knowledge and knowing. Knowledge is written in documents while in African communities, knowledge is what the community discusses.

According to respondent Kgoshi, "sometimes we bring knowledge to the people without educating them on the value of the knowledge. We want to tell people what they need." Kgoshi emphasised the importance of starting the learning process with people's knowledge to create interest. This could be done by making songs and storytelling around the fire to share people's knowledge. In his view, "when you bring something new, they get confused. They think it is jargon. It is an elephant that they cannot understand." Furthermore, Kgoshi highlighted the need for people to transfer their knowledge and to teach the youth that they can make money online by becoming content producers, sharing online, and making videos: "The community has a key role. Those who know must help those who do not know." Furthermore, the respondents proposed using a cultural preservation approach to facilitate the development of digital skills. For instance, Modjadji emphasised that cultural preservation is a driver of digital

skills development in rural communities:

By using culture, you would introduce the community to a lot, and they will discover many other things in the digital space you get. Translate some of the content into the local language because some of them might not be able to read and write, but they can hear in their local language.

Mokhobi pointed out that their approach to learning in his context is "to transform the culture into something that can be incorporated into the community network, instead of changing the culture".

Two respondents who were familiar with Mandhwane indicated that Mandhwane has a role to play in the knowledge transfer system if targeted at children or youth. Xolani highlighted that

> Mandhwane is about the pedagogical methodology used by Africans promoting play as a teaching methodology because they believe that when children play, their minds are relaxed, and when the mind is relaxed and open. Then, there is more efficacy in the teaching-learning situation.

Furthermore, Mandhwane, according to Xolani, embodies the principles and concepts of design modelling, and it is futuristic. Respondent Lerato shared a similar view, indicating that children learn best when playing. Lerato emphasised that it is critical to create enabling e-learning environments for children, while Morena pointed out that children learn about technology with ease, and it does not matter which community they come from. The following quote summarises the relationship between Mandhwane and coding:

> The first thing that we are doing in coding is to grab and drop, so we can incorporate that with uMendlwane because data is storytelling, what is it that you are getting from the data. What is the narrative that you are getting from the data? What gaps are you getting from the data? uMendlwane kids also do storytelling, acting as a mother; you read a story to your children in the evening. Those skills are critical as we develop this ecosystem in terms of changing the narrative in the dataset, data creation, data maintenance, and data expansion. These are the important aspects because part of data mining you start from storytelling, what is the story we are getting from this data set because we must not isolate data sets from the location. (Lerato)

In addition, Mankete stated that parents bring their children as young as eight to his company to learn by doing. He emphasised that children exposed to playing video games or reading Superman or Batman can start seeing Shaka Zulu as a superhero if exposed to African content, and can start changing the narrative and creating local heroes:

> I have parents who have brought kids, and the kids are grown now. They have made video games. Some are even doing degrees in computer science and trying to make video games for their final-year projects. We have been able to show that gaming is a profession.

The respondents further highlighted the need for change management at all levels of society, emphasising the need to draw lessons from Japan, South Korea, and China, re-engineering the education system and removing the fear of technology. Matome emphasised the need for a mindset change, both among leadership and the general population:

> We need to change our mindset. Because a country like South Korea, which has nothing, is not endowed with anything, it does not have natural resources (mineral, water, and topsoil), but it took mindset for it to be where it

> is. In terms of being the leader of ICT in the world. They changed the mindset. Using our cultural knowledge systems, practices, and processes, we can develop better technology using this strategic science knowledge.

Matome suggested that Africans can use technology to empower African producers and creatives to design their own technology:

> We can reverse the same technology we have imported and do as the Chinese have done. Today, the Chinese are competing with the iPhone with their Huawei. But we need to drill down even on the issues of the software. We must not only talk about the hardware; we must engage at a level of software. Both sides of the coin.

According to Matome,

> One of the critical areas of changing the mindset is to invest in a proper education. Our education is outdated. It is not only outdated, but it is irrelevant for us to achieve what we want to achieve. We need to ensure that the education that we have inherited from the colonialists is thrown out of the window and declared a pandemic for our children. We need to start by saying that let us have an education about our culture and environment and plan to have a place in the South/Sun as Africans.

Xolani emphasised that Africa will require African engineers to design systems aimed at addressing African problems. Moloto pointed out:

> We have been discussing education transformation since the 1800s. There has not been a major change except for what I see as the invention of paper. However, there has not been a big impact from paper to now. We are told that learning must happen with students and teachers at home.

Xolani stated: “We need culture to change the mindset. Because culture controls the mind.” Khoshi emphasised the need to remove the fear of technology, noting that this is a big issue in communities. According to Khoshi,

> there is a need for people who can go to the villages and educate them to show them how to access the information (eBooks, YouTube). If they know the value of the Internet, they will want to use it because their life is changing.

Moreover, Mankete highlighted that consumer perceptions and cultural upbringing on the continent affect the mindset of our people:

> Africa does not have a culture of games, comics, these exciting things; though digitalisation is happening, the culture of Africa is that if you play video games or read comics, you are not serious. If you are going to school, reading a book, and having a PhD/Masters, then you are serious. Moreover, as much as there are many African countries, this cuts across all the countries. This mentality is continental. Furthermore, this is a culture that our business must fight. So, always say that we are not only starting a business but also starting a new industry. Moreover, in starting the industry, we need to fight a lot to change this perception, which I think we have now been able to change for the past ten years.

Moreover, Mankete highlighted that local entrepreneurs often lose their trained employees to better-paying jobs: “When you get a skill, you must train that person, train the person while you are paying them. So, this also becomes

expensive." Mankete also pointed out the challenges of developing digital skills on the continent, highlighting that few universities in Africa, apart from universities in South Africa, teach full game development as a course:

> It is hard to get skilled resources to work within the continent. The lack of skills makes developing African-inspired games expensive because the skills are not there, forcing entrepreneurs to outsource to the West or Asian markets.

7.5 Digital infrastructure

In this section, I present the findings on the infrastructure required to facilitate inclusive digital adoption and enable the localisation of solutions. The respondents highlighted that digital infrastructure includes tangible, intangible, online, offline, digital, and non-digital resources available in the community and externally. In addition, the respondents highlighted the challenge of limited access to capital as a significant barrier to innovation in Africa.

In the words of respondent Motlanalo:

> Digital infrastructure is the balance between the globally and locally connected. So, it means a network that connects to all the many things on the Internet, just like Africa always or any African village did. They had these connections in the broader world. It involves balancing richer local interconnections without being limited to devices. It encompasses working towards the balance between the broader system of interconnections, which can be economical, educational, whatever you like and the local systems.

The respondents stated that communities in resource environments lack access to smartphones. Moreover, the cost of connectivity is high, as expressed by respondent Kgoshi, who highlighted that some service providers have made the Internet very expensive. Moreover, the respondents emphasised that the lack of sustainable and reliable energy contributes to the digital infrastructure gap: "The important thing first for me is the source of energy. We need communities; even in townships, we need sustainable energy and electricity because, without that, all these digital tools and technologies are useless" (Morena).

Kgoshi shared a similar view: "We need energy to charge phones because you can have a smartphone, but if you have no power, you cannot charge it." Respondent Mo emphasised that

> organisations such as the United Nations say #LeaveNoOne behind, but I think that the train is gone, and they left everyone behind and are going on their own. The UN has not addressed the problems facing people in the communities. After all, there is no source of energy and connectivity.

In addition to devices and access to energy, the respondents highlighted challenges related to normal Internet coverage, distribution of content produced by digital entrepreneurs, the rural–urban divide, and consumer behaviour:

> You made the game. How do you distribute it? Even though we have Internet coverage, the speed is very bad. On the other hand, there is consumer behaviour. The elites would keep their data on irrespective of everything and do a Zoom call, but when you go to the rural area, people turn their data off because of data charges. They turn it on to maybe WhatsApp, then turn it off. They do not download apps because most do not even have a Google account.

> The phone will have WhatsApp but not a Google account, which they do not know. (Malekutu)

Mankete stated that he uses different technologies, such as SMS, to create local content. In his words, "while in the West they just do an IOS and have a million downloads, in Africa, we have to think through different channels." Lerato emphasised that it is crucial to connect the unconnected because people cannot use technology when there is no Internet. She stated:

> Part of what the minister [of the Department of Communications and Digital Technologies] is doing is to ensure alignment between ICASA strategy and what the Public Works department is planning regarding digital infrastructure.

The respondents also indicated that the availability of technologies such as Television White Space (TVWS) presents opportunities for communities to access digital infrastructure, including offline solutions. Furthermore, Lerato highlighted that the government is deploying artificial intelligence labs as pilot sites. Kgoshi pointed out "the need for infrastructure that can help to reach people in rural areas, instead of having one big company supplying Internet to people, which is quite expensive and exploiting people". According to Kgoshi, the service providers "are making billions, making money, and leaving the poor communities behind". Respondent Morepiwa highlighted that TVWS and community networks, among other technological options, play a crucial role in addressing the challenge of providing Internet access to rural areas.

Additionally, Morepiwa emphasised that while TVWS is valuable, backhaul infrastructure, such as fibre or microwave, is necessary, and we need to explore alternative technologies like 5G, Point-to-Point (PTP), and fixed wireless. According to Morepiwa, TVWS is one of the alternative technologies available for communities in resource-constrained environments to establish central hubs that can extend Wi-Fi access to multiple locations. Furthermore, respondent Morena indicated that constructing a base station cost "something like 1.5 million". However, he further indicated that those who can invest can also quickly make the same amount of money. According to Morena, putting the base station in the community makes economic sense. He further pointed out that competition will increase once an operator connects the people: "Often operators will go where other operators go, the moment one operator goes, the other one will go, and that is how you indirectly create some quality of service and also create some competition in that area."

The respondents also emphasised that access to funding is a crucial aspect of digital infrastructure:

> The SA economy is based on access to capital. It is a capitalist economy. The private individuals (shareholders) own capital. In a capitalist economy, for one to explore opportunities, they need capital. If they do not have capital, it will just be an idea that does not see implementation. So, if somebody comes around, learns of the idea, likes it, and has the capital, they can materialise it. Consequently, those who came up with the idea will not have a share or profit in the company. Because this structure of the economy only rewards the owners of capital. (Xolani)

Respondent Morena shared that given the barriers of entry in deploying digital infrastructure, it would require the regulator to enable a process for trial and error:

> The regulator must be willing to issue test licences for people to test a particular technology. Issue the test licence. Give them time for the experiment and trial. You might say that in a particular rural area or a community with a set of circumstances, one will be prepared to reduce fees for application processes and allow people to experiment and innovate.

On the other hand, respondent Malekutu cautioned about the need to deploy prime infrastructure in rural areas, highlighting the sustainability challenges:

> One thing that is important for sustainability is called prime infrastructure. You do not want to go to rural with expensive things. It is important to have fairly costed infrastructure that takes into consideration both the Capital Expenditure (CAPEX) and Operating Expenditure (OPEX).

Kgoshi, Morena, Morepiwa, and Selemela, among others, suggested that community-led Internet service providers and community networks are some solutions that can close the digital infrastructure gap. Furthermore, the respondents pointed out that technologies such as TVWS create opportunities. Moreover, the respondents emphasised that infrastructure in an African context comprises offline local servers, local communication channels for sending educational content, digital notice boards, wireless connections, community radios, and offline content accessible through a community intranet.

Respondent Mo highlighted the need to explore natural resources and engage the community, indicating that in communities such as Limpopo, people have opportunities to obtain energy and connect because they have natural resources like the hot weather. However, first communities need to be taught how to install solar panels to power their households, and then they can power their devices in their households. Respondent Modjadji highlighted that people sometimes start the project to bridge the access divide by installing hardware. “We put this mast, and then in the process, we realised that we did not need the mast.”

According to Modjadji, it is vital to approach digital infrastructure as a process that addresses hardware, affordability, and the availability of gadgets like smartphones at the household level. Morena emphasised that “people do not need to be educated to run a network, as they have been running businesses for years without education, planting crops over these years, looking after their animals, without any education”. In Morena’s words, “people need mentorship. They do not need education to be self-sustainable. People need advice on equipment so that they do not become dependent on outside people.” Furthermore, respondent Modjadji pointed out that when looking at affordability, it is essential to consider the relevant content, and the kind of equipment or hardware required to support it.

Respondent Kgoshi highlighted the need for community participation in digital infrastructure: “The community should also be part of infrastructure deployment by providing their own houses to allow us to mount the radios and mast for free to provide affordable Internet.” Similarly, respondent Moloto described natural resources as part of his people’s infrastructure. Moloto highlighted that he relies on trees instead of digging underground or providing poles to hold the Internet cable. Mokhobi highlighted offline solutions such as intranet facilitating access to local content. One example is having an intranet with discussion forums for communities to discuss things that affect

them, and their culture forms part of the digital infrastructure. According to him, "the available offline infrastructure might enable elders to document their experiences and cultural practices to be archived, recorded, or written as stories." In line with Mokhobi's view, Morena highlighted the possibility of creating smart villages even though they are offline; this concept exists not only in Africa but even in the developed world because they also have some areas that do not have coverage. Organisations such as the United Nations, promote the Smart Village concept .

According to Morena, regulators in developed countries are forcing Internet service providers to deploy networks:

> They have big budgets, and money, and can do it. We (RSA) must also ensure that money gets channelled in the right areas. So, they are deploying what they call rural networks. They made something like 9 billion dollars available. We (SA) also need to get to that point. We do have a development fund. The Universal Service Fund in the ICT White Paper, there is room to come up with this development fund. Now the question is, how do we use that fund? And to the right people. (Morena)

While Morena pointed out the potential for offline smart villages, he emphasised that while it is acceptable to have a communal network that facilitates digital skills development, at some point, users, especially children, will need to go through to the Internet because they become inquisitive. That is where the challenge lies. He further pointed out that

> the offline network might enable older people to talk to each other in the community, but those who work in cities need to contact the people back at home, and for this, there is a need to connect to the other networks. It is a good starting point to deploy a network where a community can talk to each other, but at some point, you need to talk to other people in different communities.

7.6 Digital leadership

This theme explores the role of leadership in facilitating people-centred and contextual DT and innovation. The theme included document analysis of government policies, regulations, and programmes as artefacts of the leadership philosophy in the South African DT ecosystem. The respondents highlighted a need for re-engineering the minds of both citizens and leadership.

On the other hand, respondent Moloto highlighted that "Africans feel inferior to the point that they do not take steps to do anything unless it is initiated by someone else". The respondents pointed out that leaders on the African continent do not speak for themselves when in international forums. Moreover, the current advocacy groups speak for a

> small part of the community part of South Africa, mostly people who can afford it. But what about ordinary people in the street? How do we get those people [Advocacy Groups] to talk on behalf of those people [ordinary people]? You need a peer voice for those people.

In addition, the respondents compared South Africa to China, South Korea, and Japan, and further questioned why South Africa is not following these countries by adopting a similar mindset, indicating that on the continent, "South Africa is lacking behind countries such as Botswana and Namibia". Respondent Morena pointed out that South

Africa is trying to reclaim its position on the continent:

> Our challenge in this case is leadership and buy-in from all sectors. We turn to fight ourselves. We turn to restrain ourselves. I think it is important that we buy into the same concept. For example, the NDP was developed many years ago, but there was no review. I saw the other day that the PC4IR report came out, but if you look at what is in there, I mean, and then you ask yourself, what is the implementation plan? Everybody is saying we must be ready for 4IR. We are busy developing these nice documents. It is about the implementation plan.

On the other hand, respondent Mo pointed out that hierarchy and red tape are some challenges facing leadership in the South African context. In his words:

> This whole thing at the hierarchy and the red tape element is redundant because white people do not hold the red tape. Our people hold it. Our people are the ones that are sitting in the right seats but making wrong decisions for their people.

Regarding the allocation of resources, respondent Matome highlighted the mindset that "many people look at Africa and South Africa and say this is a rural country, and that is a curse". According to Matome, leaders must invest in the infrastructure in rural communities to ensure that there is fibre even in far-flung areas. Matome emphasised that there is a need to change the narrative based on the uniqueness of rural areas, highlighting that leaders who understand the uniqueness of the rural villages should view their places as a blessing and invest money in those areas because that is where their blessings are located. Moreover, Matome pointed out that South Africa's education system is outdated and irrelevant:

> Our education is not only outdated, but it is irrelevant for us to achieve what we want. We need to ensure that the education that we have inherited from the colonialists is thrown out of the window and declared a pandemic for our children. We need to start by saying that let us have an education that talks to our own culture, our environment, talks to our plan, to have a place in the South/Sun as Africans.

Respondent Morena pointed out that South Africans are nomadic: "We all work in the cities, but come December, we all go home, and you are expecting the same service, and COVID demonstrated that very well." Matome emphasised that the regulator must ensure that operators up their game and that, wherever people are, they put in the systems and upgrade them.

> We have a particular situation in KZN, near the Mozambique border. There was no coverage. We went there on a campaign with the minister, and suddenly, they put a temporary base station there, and now everybody has access to communications.

Respondent Morepiwa pointed out that at the practice or implementation level, policy makers and regulators often focus on addressing the supply side. According to Morepiwa:

> It is easier to count the number of computers provided, the number of handsets issued, the number of people connected to the Internet and the number of people trained. Measuring what local communities or beneficiaries attach value to is not the priority for leaders because DT is often driven by self-interest, resulting in imposing

> interventions.

Furthermore, the respondents shared that there is an opportunity to include demand issues at the policy level and to support citizen-led approaches. For example, respondent Morena emphasised that policy owners and regulators need to support communities by guiding them to establish citizen-led consortiums that can do advocacy work to ensure that they are included in decision-making and policy formulation that affects them.

Morena highlighted that rural people have capabilities that do not depend on education. He stated that rural people need advice on how to participate in the telecommunications industry without depending on external people.

> Our people have been running businesses for years without education. We have been planting crops over these years, looking after our animals for years, without any education. You do not need education to be self-sustainable. People need advice on equipment so that they do not become dependent on outside people.

Modjadji expressed a similar view, indicating that it is possible to build the capabilities of the communities to lead the process of connecting the unconnected. However, Modjadji stated that this is not happening:

> We are not doing it because we are selfish. It comes back to power. I think we are selfish. We think we are the only ones who are supposed to know. It comes back to power to me. I feel we want to keep things to ourselves to control these people. We know they can do many things, but we fear to equip them with the knowledge because they will remove the power from us.

Respondent Morepiwa highlighted that besides providing local and culturally appropriate content, there is a need to look at the business and governance models for community networks. According to Morepiwa, collective ownership is critical for managing potential conflicts when implementing community interventions.

> I got to manage a project that was making videos for one project. One of the videos was about connectivity in one of the most rural areas. We sent the TV crew out. The problem was that the community was at the intersection of two communities. […] So, there was tension between the two villages. There was a power struggle as to who had governance control over the project. Because it was a poor community, suddenly, there were these computers or resources, and it became a big tussle over who had control over those resources. What happened is that the committee got paralysed, the telecentre was vandalised, and most of the equipment was stolen, and when the crew arrived, what was left was one woman who […] was driving around with laptops, setting them up, teaching people how to use computers. It was far from what was initially envisaged.

The respondents pointed out the importance of establishing governance structures that are inclusive and collectivist. As Morepiwa stated:

> It is critical to look at the dynamics in the community, what are the tensions, what are the fights, how can you set up the structure, how can you set up the structure that is going to function and value and support what you do rather than the one that is going to become a source of tension.

Modjadji emphasised the need for participatory and inclusive approaches when engaging with communities, which

must be the top priority. According to Morepiwa and Modjadji, it is vital to manage community dynamics to minimise tension: “So, collective ownership models. Make the structures align with what is already in existence in the community.” At the same time, Mokhobi emphasised the importance of understanding the historical wounds in the targeted communities by engaging with the community leaders. In Mokhobi’s words:

> A particular community might not like the experiences that they have gone through, so you should not go and touch somebody’s wound. So, there are things that you should do and handle with care in the community.

Modjadji pointed out hidden agendas in the ICT4D value chain, as the meso actors sometimes exploit the communities for their own benefit. In some cases, they engage with the communities to meet the expectations of the donors:

> Some people who go to communities aim to complete what they promised to the donors, to meet their expectations. They have written a proposal, which they did not even consult the communities in the first place, so they created a certain image to the donors and want to give exactly what they promised.

In addition, Modjadji highlighted that, in some instances, donors come to the meso actors expecting certain things and particular results:

> They want certain information. They do not want reality on the ground. They want what they want to hear so that what happens is that someone who needs money from the donor will do exactly what the donor wants.

According to Modjadji, the chain of hidden agendas extends and replicates at the micro-level. Moreover, the respondents pointed out a need for re-engineering the mind at the consumer level. According to the respondents, Africans do not always support one another and are comfortable consuming digital products and services from other continents, as captured by the statements of Mankete, Modjadji, and Xolani. Mankete emphasised: “The consumer side has a component of culture, perceptions, cultural upbringing on the continent, which targets the question of the mindset of our people”. Modjadji pointed out the challenges, stating:

> Africans can come with our own technology, except that we are our own enemy. We have a double problem because the other countries are exploiting us, and instead of supporting ourselves, we are our own enemies.

Xolani highlighted the preference for non-African digital products, noting that

> people are still comfortable consuming digital products from Asia Western without thinking twice about it. However, if you were to try and sell them an African system, they will think a thousand times before they decide because of the mindset.

7.7 Highlights from the macro- and meso-level perspectives

The macro- and meso-level findings indicate that African culture is rooted in the value of collectivism. The family and clan are the foundation for collective capabilities. In South Africa, the proverb “Motho ke motho ka Batho ba bangwe” (I am because we are) expresses collectivism. Moreover, spirituality intertwines various aspects of daily

life. However, the digitalisation discourses exclude the systems consciously or unconsciously. The colonial nature of knowledge production systems further perpetuates the exclusion of African cultural knowledge systems. In addition, the document analysis highlights that the government regards cultural heritage as input into the national systems of innovation, the DKE, and the 4IR. However, there is a gap between policy and practice. The digital skills dimension highlights the importance of embedding learning into everyday activities rather than relying solely on formal classroom settings. In addition, the respondents emphasised that digital skills interventions require starting with what people know and then taking them through a process to discover the unknown, using cultural heritage as an approach. Furthermore, digital infrastructure reflects the worldviews and values of its producers, resulting in the provision of digital technologies and solutions that are not always aligned with people's daily realities and experiences. Moreover, it encompasses tangible and intangible resources, both online and offline. Community networks are emerging as complementary solutions for communities in resource-constrained environments that could integrate energy solutions and promote offline solutions for capacity building. The digital leadership findings indicate a need for fostering a digital mindset, which involves re-engineering the mindset at all levels of society, including citizens, leadership, and the re-engineering of the education system. Additionally, the findings highlight the importance of understanding historical wounds and how these shape or influence decision-making, programme design, and resource allocation. The findings also indicate that the values and ethics of some of the actors who lead and facilitate DT contribute to digital entanglements as they often pursue pre-defined outputs for their funders and, in some instances, have hidden agendas that serve the interests of individuals over the community interest. Moreover, due to power dynamics, the hidden agendas often replicate at the community level, creating tensions.

CHAPTER 8 ：TOWARD AN AFRICAN-INSPIRED AND CONTEXTUAL DT IN MTA

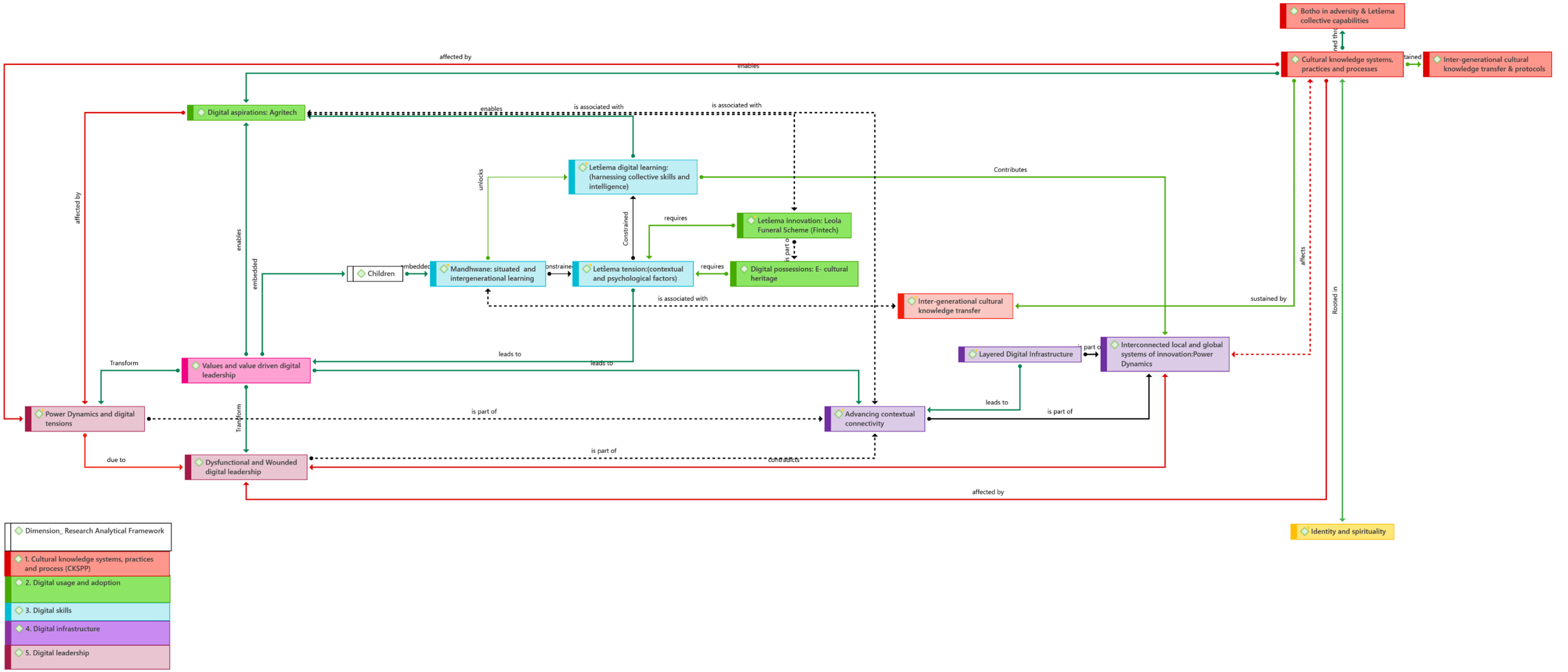
8.1 Introduction

In this chapter, I provide a detailed analysis of the research findings to explore how cultural knowledge systems facilitate active and inclusive participation in DT by African communities in resource-constrained environments. My analytical approach combines social constructivism, the Afrocentric paradigm, and a critical lens. My Afrocentric paradigm is grounded in the NTU ways of Being (Mun-tu, Na-NTU, Ki-NTU and KU-NTU) as well as the ontological and epistemological perspectives discussed by Ramose (2005) and Zulu (2013). As a social constructivist and Afrocentric researcher, I view reality as the output of multiple perspectives shaped by the relational aspects of entities in the context of their creation (Howell, 2013). Additionally, I discuss how power dynamics and sociological perspectives shape the DT ecosystem (Jackson et al.,2021). The chapter is organised according to dimensions generated from themes developed through an inductive data analysis approach, starting with the visualisation of the narrative generated illustrated in Figure 8.1. The purpose of the navigation tool is to provide a framework for understanding the interconnected dimensions of the contextual DT ecosystem, with cultural knowledge systems at the core of the transformation. Importantly, the interconnected dimensions form a dynamic and interdependent ecosystem aligned with the reality of African philosophy, where the forces of existence are interconnected and cannot be separated from the whole. The navigation tool suggests that the absence of any dimension from the whole would disrupt the functionality of the system and its transformative potential.

Naeem et al. (2023) postulate that theme development allows the researcher to transition from a detailed analysis of codes and categories to creating themes that go beyond merely recurring elements, as they embody patterned meanings that link the research questions and data. Rather than using the original dimensions from the analytical framework, I generated new dimensions to capture better the nuanced insights and relationships identified during the inductive data analysis. Following this approach, while I retained the broader theme of cultural knowledge systems, the other themes from the analytical framework were updated. For instance, contextual digital knowledge economy replaces digital usage and adoption, emphasising that digital engagement becomes meaningful when rooted in the community's everyday aspirations, practices, and processes, as exemplified by the case of MTA. Similarly, intergenerational digital learning and innovation transcends a simplistic view of digital skills by focusing on the deeper processes of contextual knowledge transfer across generations.

Batho-centric digital infrastructure broadens the concept of infrastructure beyond devices and internet connectivity, integrating the African thought system of duality and interconnectedness. Finally, digital leadership in transition offers a framework for navigating the evolving nature of DT while addressing historical legacies that constrain efforts toward a people-centred DT by committing to values-driven digital leadership rooted in Afrocentric canons. These refined dimensions guide the chapter's discussion, with subsections aligned to the elements of the navigation tool. Each section starts with the Atlasi.ti generated figures to guide the reader through the discussion. This approach maintains continuity with the analytical framework while visually presenting a narrative that integrates deeper insights by the case of MTA.

Figure 8-1: The interplay between the dimension of the research analytical framework and the complexity of the DT ecosystem



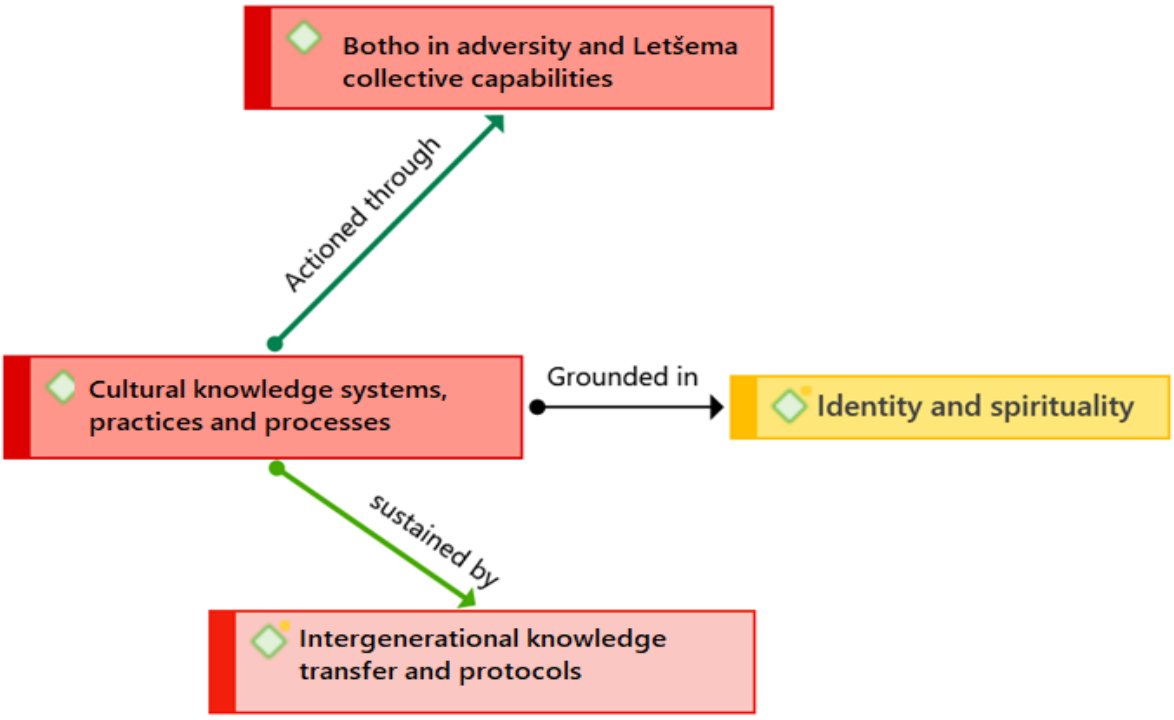
Note: The Atlas.ti figure illustrates the dynamic relationships among the components in the contextual DT and innovation ecosystem and the intersection between the macro-, meso-, and micro-levels.

8.2 Cultural knowledge systems practices and processes: Identity and spirituality

In this section, I explore CKSPPs, which serve as foundational components in investigating the main research question: how do deeply embedded cultural practices unlock collective human capabilities for inclusive digital adoption and use? The findings suggest that CKSPPs are interconnected, encompassing both tangible and intangible aspects of communal life. The respondents reported that African communities employ collective capabilities known as Letšema and trial and error to implement CKSPPs. Furthermore, intergenerational cultural knowledge transfer and protocols contribute to sustaining CKSPPs. The protocols govern access to knowledge and how to apply cultural practices. In the context of the MTA, Letšema collective capabilities and Botho in adversity combine the capacities of interconnected individuals in the community and their family structures.

Botho in adversity involves the collective coming together of community members to comfort and support those experiencing difficulties, such as funerals or property loss. Kinship rooted in ancestry serves as a unifying force, fostering cohesive values and strengthening bonds among people. Additionally, family dynamics, community agency, and cultural values shape Letšema capabilities. The themes illustrated in Figure 8.2 collectively provide insights into how CKSPPs shape the participation of communities in contextual DT and innovation.

Figure 8-2: ATLAS.ti generated themes illustrating the interconnectedness of CKSPPs



Note: The Atlas.ti figure illustrates that CKSPPs are interconnected systems rooted in identity and spirituality, transferred from one generation to another following prescribed protocols, actioned through Letšema collective capabilities and Botho in adversity.

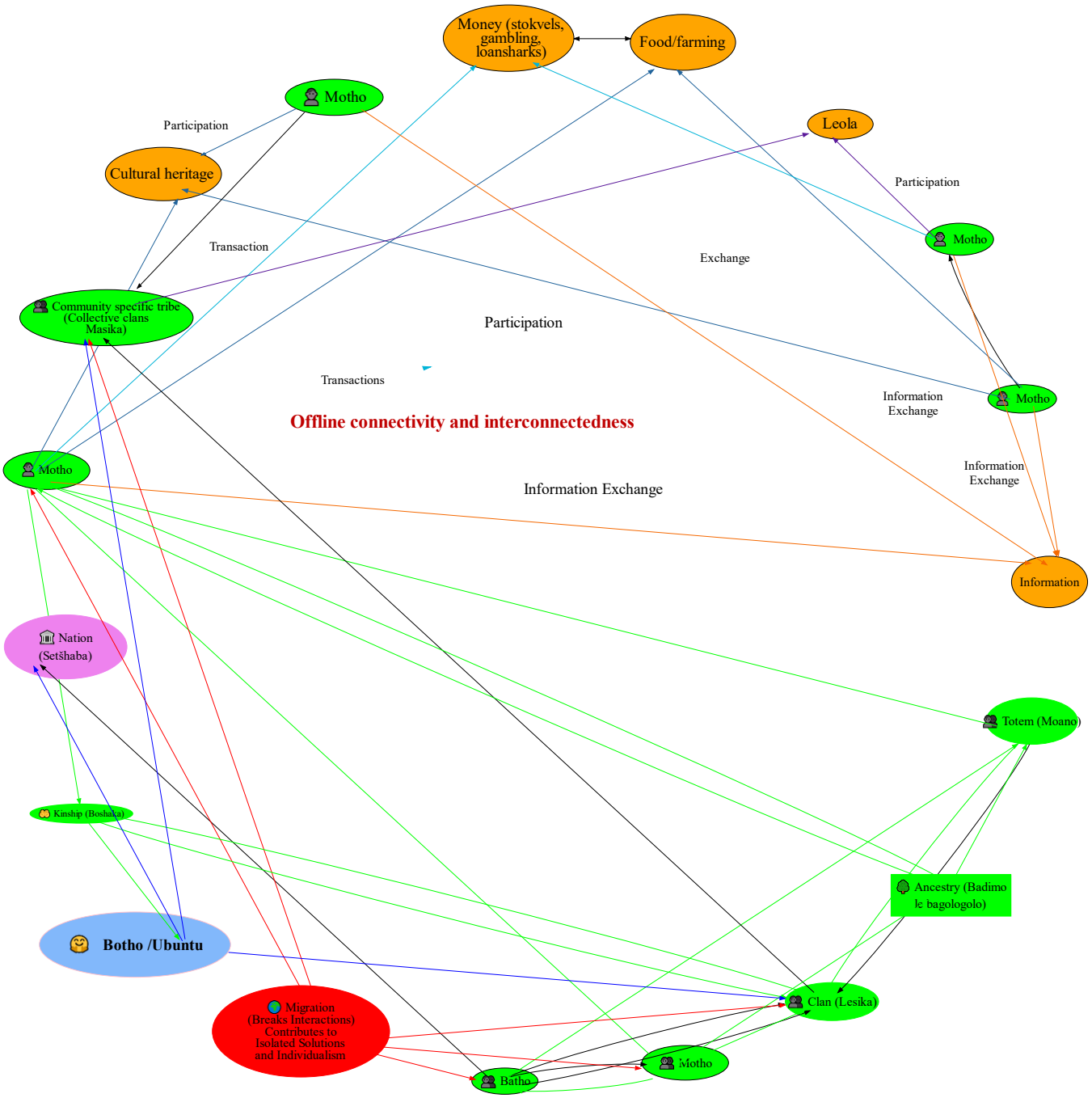
Expanding upon the observations derived from CKSPPs, the results show that culturally rich and diverse practices and systems exist across different African communities. In the context of the MTA, these practices encompass various customs and rituals, including libations, naming conventions, totems, communal by-laws such as the Leola funeral scheme, and family gatherings such as Aretsebaneng. The practices reflect the ontological, epistemological, and axiological foundations of African philosophy, as discussed by Ramose (2005) and others. Furthermore, ancestry plays a vital role in shaping people's identity in the context of the MTA. Ancestry is one of the threads that connect Motho to Batho (other people), who collectively recognise their existence through the existence of others.

The family represents individuals connected by blood or marriage. Additionally, it is a unit that is composed of Mashakha (relatives) who share the same totemic ancestor (Moano) to make up a clan (Lesika). The clan represents larger family groups connected by kinship (Boshakha). Different clans collectively form a community (Masika), which in turn contributes to the creation of a nation or nations (Setšhaba / Ditšhaba). For example, a family contributes to the creation of clans made of multiple families who are relational, known as Mashakha (relatives or kinship). Boshakha (relational and kinship) empowers individuals to activate their collective capabilities, called Letšema.

In the context of the MTA, kinship is one of the values evidenced by the ability of community members to trace their genealogy beyond the 18th century. In contrast, a shift in the family structures weakens the collective capabilities. The study suggests that the interconnected individuals and their interactions with contextual forces collectively represent the entirety of Motho (human). Thus, Motho's existence is not isolated but interconnected to Batho (other people), their collective well-being, and NTU. Therefore, Motho's identity is deeply rooted in ancestry, family structure, and clan affiliation, similar to the AmaXhosa people, as observed by Bidwell (2010). Moreover, the data suggests that while the individual is a vital component of the family structure, African society believes that the collective is of greater importance than the individual. Therefore, the family and clan are the sources of collective capabilities. Consequently, Botho attributes, such as generosity (go loka) and empathy (kwelo bohloko), foster social cohesion in the clan and community.

On the other hand, the findings indicate that migration weakens family structures, often leaving children and older people in the villages. This weakening of family structures has consequences for adopting and using technological innovations within the Letšema processes. As a result, children and older members might lack access to digital devices and connectivity because they often cannot afford such digital assets due to the absence of economically active household members. Thus, assessing how family structure and community agency influence and shape the adoption and use of digital technologies and applications is critical. Figure 8.3 illustrates that ancestry, and clans serve as the central hubs in the African family structure, giving rise to the Letšema collective capabilities. These core nodal points facilitate interactions and exchanges among Batho in their temporal spaces. Various forms of exchange, including cultural heritage participation, food and farming exchanges, information sharing, community initiatives participation, and financial transactions, reflect a networked cooperation system and a non-digital economy.

Figure 8-3: African social and economic structures and community dynamics



Note: This figure illustrates the African community structure as described by the research respondents and its interplay with social and economic dynamics, such as the impact of migration on the African family structure. The figure also illustrates the interconnectedness of the African family structure and its relation to ancestry and NTU, expressed through totems, praise songs, and naming conventions. Source: Author, 2024.

The practices in the MTA illustrate the interconnectedness of the NTU cosmic forces[15] in shaping daily life as a continuum where the past, present, and future intertwine. The respondents indicated that non-digital systems like

[15] Umu-NTU, Iki-NTU, Aha-NTU and Uku-NTU.

naming conventions, clan praise songs, and totems play a vital role in remembering ancestral talents and skills and retrieving historical events. According to the respondents, although names are part of human identification systems, in African communities, the protocols around naming are an integral part of knowledge preservation. For example, some African societies use names to store life events such as birth, death, environmental changes, adversities, resilience, and prosperity, among other things. Totems and praise songs store and encrypt the skills of the totemic ancestor for the retrieval of knowledge by future generations and to serve as navigation tools or systems. Moreover, totems, naming conventions, and praise songs are non-digital technological systems that interconnect individuals (Batho) with their ancestry in various African communities. These elements serve as conduits that interconnect individuals (Batho) with their totemic ancestors and cosmic forces during the Makoto process (rain petitioning) (Sipeyiye, 2023). For instance, in the context of the Balobedu, the rain petition process, as observed by Krige and Krige (1943) and as exemplified by the Ramafalo Moano (totemic praise poem)[16] encapsulates the interconnectedness of Batho with their environment and non-digital technological systems, as captured by their praise poem:

> Agee Kolobe wee!
> Agee Lešitele le Semetsi le-wetša-madiba-a-Kwena
> Ke motho wa ga Mafalo mafal'a ntlong
> Mokoto a fala ka Naka la pula e a na
> Motho wa ga Mmahlaka, ke motho wa ga Mmaseepe sa go rema tlhaka le palelo.

"Ke motho wa ga Mafalo Mafal'a ntlong, Mokoto (Motho) o fala (action or doing) ka naka (Ki-NTU) (horn) la pula (rain or cosmic element) e a na (it rains (the state of))" captures the technological devices employed by the Ramafalo totemic ancestor during the rain petition process, while the name "Mafalo" encapsulates the essence of being Motho in the Ramafalo clan system. In essence, the Ramafalo praise song encapsulates the essence of being, knowing, and doing, and the interconnectedness with the water cosmic elements as well as the animal kingdom ("Kolobe" means "warthog" and "Kwena" means "crocodile"). The naming system connects the living and the departed and affirms the agency of the totemic ancestor in shaping identity, reinforcing good behaviour, building confidence, and character modelling for children who are named after their ancestors. The study found that in the case of the MTA, totems remain integrated into people's daily lives, serving as forms of everyday community expression and the highest level of expressing one's identity. In the MTA, totems and praise songs are engraved in various families and clans, expressed during life-changing events such as weddings, funerals, and celebrations to invoke ancestral presence and agency. Therefore, the naming conventions of children, totems, libations, and praise songs reflect the interconnectedness of the NTU cosmic forces. The findings highlight the critical role of spirituality, identity, and cultural practices in shaping digital aspirations and technology adoption in the community. In the MTA digital applications enable the funeral economy, connections with the totemic ancestor, and the preservation of culture and

[16] See the praise poem on page 6.

family history. Therefore, examining the interplay between spirituality, identity, and cultural practices is vital when introducing innovation in communities such as the MTA. Such an examination could help innovators determine how these practices may serve as catalysts or hindrances for inclusive and active participation in contextual DT.

8.2.1 Botho in adversity, Letšema collective capabilities, and economic aspirations

In the MTA the essence of being human (Motho) is rooted in one's interconnection with other people (Batho). As discussed in the literature, before the disruption of the African family and social structures by colonial forces, communities relied on their collective capabilities to engage in both economic and non-economic activities. The findings suggest that while there is an erosion of collective capabilities known as Letšema, in the context of the MTA, the expression of collective well-being and capabilities is evident during adverse events such as funerals. Furthermore, the communities demonstrate and express their interconnectedness through their clan burial societies which are often interlinked with Aretsebaneng (annual family gatherings). The data suggests that community members draw upon the values of "Motho ke motho ka Batho ba bangwe" to create systems that offer mutual support during challenging times. Moreover, as the data shows, attributes such as compassion, interdependence, and communal support inherent in Botho serve as the foundation for mobilising collective action in the community. For instance, the Leola funeral scheme allows the community to rely on their collective capabilities to manage adverse situations like funerals or property loss.

Furthermore, the study suggests that in the context of the MTA, Leola is a highly regulated scheme governed by a constitution, with the Mamaila tribal council playing a role in holding Maola accountable and mediating the conflicts that often arise from the process. The respondents expressed concerns about the diminishing practice of Botho due to selective application, which reduces Botho and Leola to a by-law. For example, the respondents agreed that people who do not participate in the Leola funeral scheme are not guaranteed the support and assistance offered to those who do participate in Leola. Moreover, people who do not participate in the Leola funeral scheme are required to pay Diphiri (gravediggers) for the gravedigging service. While most of the community participates in the Leola funeral scheme, some community members participate out of a sense of compliance rather than the act of Botho values. The data suggests that the compliance approach contradicts the essence of Botho values by reducing Botho to a transactional framework. According to the respondents, those with resources often participate in Letšema due to local protocols rather than core Botho. Therefore, fear-driven participation in the collaborative by-laws reduces the Botho attribute to an act of compliance, so that people can avoid being isolated by the collective. Consequently, Botho, in the context of Mamaila, is limited to serving the broader aspirations of the community and individuals.

The study suggests that having access to money is a critical factor in enabling people to participate in such community processes. This finding highlights the significance of money as both an enabler and a constraint for collective actions within the framework of Botho. It suggests that while money may not be the focus for individuals, having access to money is essential for their inclusion and participation in meaningful community processes, including participation in DT and the economy. Thus, contrary to the approach that often seeks to separate money as a necessary commodity

within Batho by advancing collective well-being over money, the data for this study suggests that money is entwined with the forces of being as a Ki-NTU that enables or constrains Motho and Botho.

The findings suggest that at both the macro- and meso-levels, community leaders and stakeholders share the belief that the limited contribution of collective capabilities to the local economy is, in part, due to an inferiority complex and a lack of support for homegrown solutions. For example, in the case of the MTA, community leaders stated that people do not see the link between the economy and culture. This is attributed to their inferiority complex and mindset, which leads them to devalue locally made products. According to the respondents, this lack of support has weakened the local economy because it enables big businesses to extract value and money from the community. According to the community leaders in the MTA, the inadequate support for local businesses inhibits the growth of local talent and innovation. Furthermore, the leaders pointed out that the community of the MTA has the potential to harness its collectivism in a way that could expand its capabilities to exchange assets and ensure that money circulates within the community. However, a lack of self-confidence in communal capabilities is a barrier to growing the local economy. On the other hand, despite the views expressed by community leaders that culture does not contribute to the local economy, the survey respondents indicated the existence of a value chain between cultural practices such as Letšema and the MTA economy. Despite the constraints, the data suggests that the community has a strong sense of agency and self-determination, driven by Botho in adversity.

Furthermore, the data also shows that the economic activities are linked to an undocumented seasonal calendar, with the main focus on social gatherings such as weddings, funerals, family gatherings, and initiation celebrations. Moreover, agriculture and communal financial systems play a significant role in driving the local economy. Botho and Letšema enable the creation of financial systems such as stokvels, and Maputha (the collective buying of household assets and exchange). In addition to Leola, there are emerging crowdfunding initiatives that focus solely on food and drinks. Moreover, despite the evidence supporting collective capabilities in financial groups and the funeral economy, individual aspirations often contradict collective goals. The tensions suggest the need to move beyond the assumption that individuals universally embody the value of Botho irrespective of their socio-economic conditions and the psychological factors shaping their lived realities. Despite the inherent discomfort surrounding the intersection of death and economic pursuits, the study identified an existing economic framework and digital entrepreneurship in the community intersecting with the funeral value chain, farming, and cultural heritage. In conclusion, the findings highlight that it is crucial to understand the factors that shape the interplay between Botho, community behaviour, aspirations, and spiritual and psychological factors.

8.2.2 Intergenerational cultural knowledge transfer

The data suggests that African societies sustain CKSPPs through intergenerational knowledge transfer, guided by established and prescribed protocols. Furthermore, knowledge production and transfer are holistic, communal, and action- and future-oriented. In African contexts, knowing and knowledge are outcomes of embodied experiences, sensing, and observing. For instance, respondent Xolani highlighted the African proverb “Tsebo ya nnete ke tsebo

ya letswele go bane letswele ke nnete" (true knowledge comes from the breast) to illustrate how knowledge is understood in an African context. This proverb implies that, in the African context, true knowledge is not limited to intellectual pursuits but is deeply connected to the lived experiences of individuals in their communities. As discussed in the literature, African societies intentionally equipped children with skills and knowledge, to prepare them for their future roles. For instance, in the context of the study, children actively reclaim cultural practices such as the Sekhapa music genre and recite clan praise songs. The older members of the family, known as boRakgadi, are often intentional about transferring the skills to recite praise poems to children. The findings further demonstrate the presence of active engagement in knowledge transfer and the continuity of cultural practices. The proverb "Rutang bana ditaola, le se ye le tšona badimong" (the intentional transfer of wisdom, knowledge, and skills to the younger generation) encapsulates the futuristic approach embedded in African knowledge transfer. The proverb highlights the importance of imparting cultural wisdom to the next generation, ensuring the preservation of heritage and knowledge.

In the MTA, language is not only a system of communication. It plays a critical role in shaping identity and fostering social cohesion. The case of the MTA further demonstrates that language serves as a means of encoding, encrypting, and preserving information and knowledge for future generations. It comprises a complex system that embeds psychological and motivational aspects. For example, the name "Leola" denotes that the scheme was created as a community beneficiation fund to help community members deal with the loss of their loved ones and to provide support in running the funeral as shown in Table 8.1. Thus, the root of the word "Leola" comes from "Mohola" (something that is highly valued). Therefore, Leola is a contextual and culturally grounded expression encapsulating the significance of humanness in times of adversity, specifically death. In the context of a death (Lehu) the community demonstrates solidarity and provides financial and emotional support to the bereaved. The etymological connection between the terms "Leola" and "Mohola" provides valuable insights into the cultural significance attached to the practice of the scheme in the community. Additionally, the link between Leola and Lehu aids the community in understanding the purpose and focal point of the Leola funeral scheme, creating an implicit boundary or an unwritten governance system. The cultural significance and etymological root of the Leola practice demonstrate the importance of understanding the nuanced aspects of community practices embedded in the language; a failure to grasp these nuances can lead to the oversimplification or misinterpretation of cultural practices.

Table 8.1: Linguistic and cultural significance in the MTA's Leola funeral scheme

Concept	Meaning
Mo-hola	something valuable
Le-hu	death
Le-hola (Leola)	funeral scheme

Note: The table illustrates the linguistic and cultural dimensions inherent in the Leola funeral scheme in the MTA, showcasing how language plays a crucial role in shaping identity and fostering communal practices.

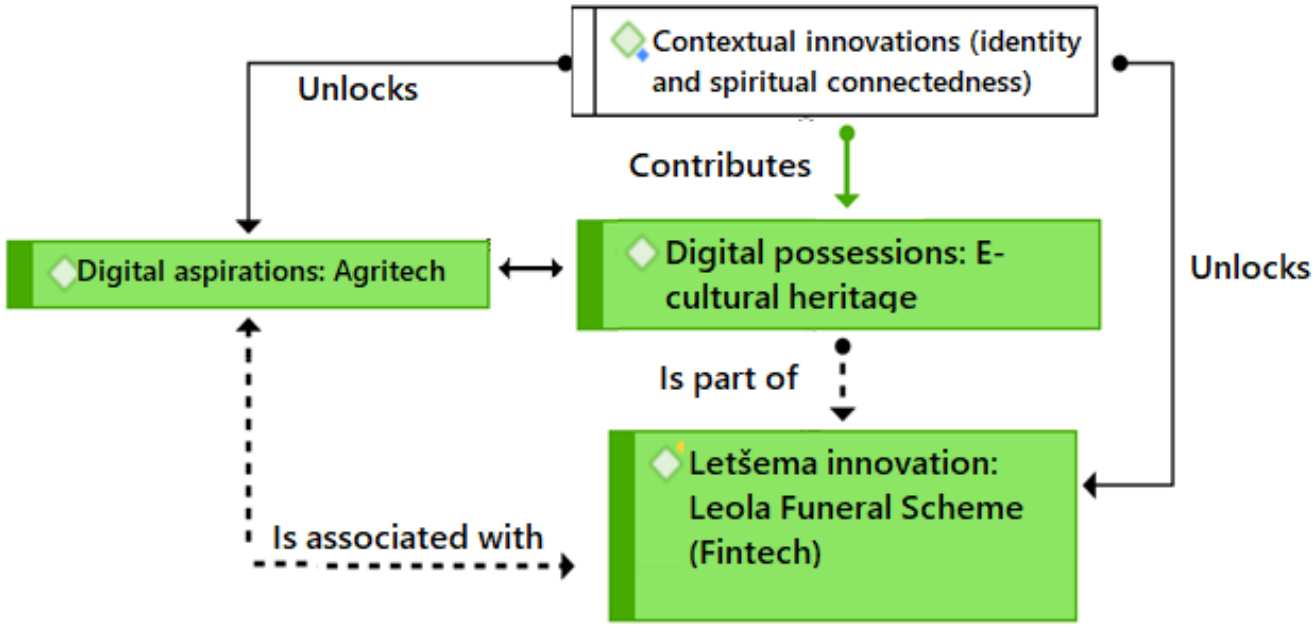
The etymological example highlights the pivotal role of language in shaping how individuals interpret reality and shape innovation processes. Thus, the psychological and emotional elements embedded in the Leola practice hold significant implications for DT, highlighting that language plays a critical role in understanding contextual innovations and their intersection with the digitalisation process beyond technological artefacts. In response to the research question – how do deeply embedded cultural practices unlock collective human capabilities for inclusive digital adoption and usage? – the study found that while Botho is widely acknowledged as an embodied value by virtue of being an African, specifically South African, Botho is not a static value. Instead, it is a dynamic moral and idealistic framework that is shaped by the experiences of people in a specific context, influenced by internal and external structures. For instance, while Botho attributes contribute to contextual innovation, it is critical to consider how such attributes are impacted by factors such as migration.

The study found that even in cases where people rely on Botho in times of adversity, they do not always trust each other, even in the same village or household. While acknowledging the limitations associated with Botho, the study reveals its role in providing a moral foundation for self-organisation and unlocking Letšema collective capabilities, essential for fostering contextual digital and non-digital innovations. Intergenerational knowledge transfer serves as a holistic and forward-looking approach rooted in communal experiences, complemented by language functioning as a system for encoding, encrypting, and decoding ancestral knowledge and wisdom. In conclusion, the study highlights that CKSPPs are deeply rooted in spirituality and identity.

8.3 Contextual digital knowledge and innovation

In this section, I discuss the dimension of contextual DKE and innovation to explore the question of how culturally embedded approaches facilitate inclusive digital adoption and use to enable contextual socio-economic aspirations. Figures 8.4 illustrate a layered ecosystem of digital innovation that integrates cultural, economic, and technological dimensions, emphasising identity and community as foundational elements centred on identity and spiritual connectedness. This demonstrates a human-centric approach to digital transformation, where technology serves not only practical needs but also preserves and enhances cultural identity. The link between the aspirations of the MTA community, identity, and spirituality, including the potential role of digital technologies (Ki-NTUs) in transforming cultural heritage, community-based financial services, and farming, reflects a holistic and interconnected framework for facilitating digital and non-digital DKE and innovation.

Figure 8-4: The interplay between identity, spiritual connectedness, and digital aspirations



Note: This Atlas.ti figure illustrates how identity and spiritual connectedness enable digital aspirations, including agri-tech and fintech.

The next section offers insights into how the MTA community engages with the DKE by experimenting with fintech, agri-tech, and e-heritage. Collectively the case studies highlight the transformative potential of digitalisation across the three domains, demonstrating how the integration of digital technologies with CKSPPs could unlock opportunities for contextual DT.

8.3.1 Letšema innovation: Leola funeral scheme (Fintech)

Traditional economic practices such as bartering, labour exchange, and contribution-based systems, both financial and non-financial, play a vital role in the local economy of communities constrained by resources. Moreover, the localised economic transactions, rooted in self-determination values and Botho in adversity, demonstrate the potential to unlock contextual DT. The findings emphasise that Leola is deeply rooted in the ontological underpinnings of African philosophy, where the essence of being and existence are inseparable. For instance, the data demonstrates that the Leola funeral scheme operates as a multipurpose platform that connects various aspects, including the spiritual dimension related to death.

The integrated approach of the Leola funeral scheme promotes multiple uses that intersect with economic, cultural, social, and spiritual aspects. Thus, digital solutions for communities such as the MTA must have the capability to address multiple uses to align with the African thought process of duality. The historical African approach to technology, as respondents describe, aligns with Mavhunga's (2014) observation that African technologies

characterise multifunctionality, deep integration into daily life, and reliance on collective work. Therefore, digital applications must be dynamic and responsive to the multifaceted needs and aspirations of communities, as Villepastour (2010) and Oluga (2012) observed when analysing the interconnectedness of the Yorùbá Bàtá drums, rather than just addressing singular issues that advance individual aspirations. Additionally, the findings suggest that when designing digital solutions like the Leola funeral scheme or any technology in African communities, it is crucial to understand that technology in the African context is not just a tool or gadget but a reflection of the philosophical thought system. For example, the representatives of Maola groups regarded the app as a tool capable of increasing transparency and accountability, sharing knowledge, improving neighbourhood safety, and connecting them to the spiritual world through ancestry functionality, rather than only solving financial accounting challenges.

The data suggests that while migration weakens the African family structure, migrant workers maintain a spiritual connection to their place of birth in the context of the MTA. Consequently, migrant workers exhibit dual roles, both absent and present, signifying their emotional attachment to their place of birth and clan processes. The participation of migrant workers in the Leola process highlights their need to stay connected with home, especially with matters concerning death, funerals, and clan or family gatherings. Innovators could create digital applications that resonate with individuals who have left their villages but still maintain strong emotional and spiritual ties with their place of origin. Digital technologies play a crucial role in maintaining social bonds and capital in the MTA, as migrant workers rely on word of mouth to stay updated on the Leola funeral scheme, death notices, and Aretsebaneng invitations. Migrant workers also depend on their neighbours or family members to manage financial transactions and represent them at Maola meetings.

In some cases, the absence and aspirations of migrant workers create tension. Therefore, the study suggests that tension arising from the knowledge gap among migrant workers on communal processes could catalyse contextual DT beyond the funeral scheme. For instance, the data suggests that although migrant workers did not directly participate in the co-creation and co-design of the Leola prototype, their dual presence and transactions have motivated some of the executive members to digitalise the Leola process. This finding implies that while the migrant labour system has a negative impact on the strength of the African family structure, people rely on digital technologies to close the spiritual and emotional gaps. The proverbs “Gae bo wela kalana” (home, where the umbilical cord is buried) and “Gae ga mahlaku” (the place of abundance) express the interconnectedness of one’s spirit and soul to one’s birthplace. These proverbs imply that one’s birthplace is not just a physical location, but also a deeply ingrained part of one’s identity, representing a spiritual and emotional connection that transcends physical distance. Therefore, understanding the spiritual and emotional connections that migrant workers and people in the diaspora have to their place of birth could serve as catalysts for contextual innovations, inspiring new approaches and solutions beyond traditional methods like remittances. Data suggest that while the community of MTA is affected by migrant labour system, elderly members of the community retire in the village. Consequently, they contribute to the development of the community in areas such as Maola funeral scheme, bridging the gap between the literate and illiterate, while introducing new practices and ways of doing. Thus, understanding the skills of Bagolo who are retired contributes to unlocking Letšema capabilities.

a Intergenerational tensions and future responsibilities

The insights gathered from the Leola prototype indicate the importance of adopting user-centric approaches in the design of digital technologies. While the representatives of Maola identified the potential to digitise and digitalise the Leola funeral scheme, some members expressed concerns that the processes could introduce vulnerabilities and new forms of exploitation by their grandchildren. In contrast, the youth felt excluded from the day-to-day management of the scheme by the Batho ba Bagolo (the elders). The perceptions of exploitation and exclusion suggest intergenerational and knowledge gaps in the community. Therefore, it is important to involve the different age groups as co-creators and experts in their contextual environments during the design process. Furthermore, although the Bagolo expressed fears and potential vulnerabilities, the data suggests that they are aware of functionalities such as money transfers. For example, the prototype did not include functionality to receive payments.

During the testing process, some of the Bagolo recommended that if the prototype is going to be rolled out, it must have the functionality to issue proof of payments to avoid fraud. In addition, they proposed a dual approach, suggesting using both manual and digital solutions in parallel until everyone is comfortable with the new platform. In contrast, younger household owners who are members of Maola demonstrated readiness to integrate the prototype into their manual process, using it as a pilot to assess its value. The duality strategy aligns with African philosophical ontological perspectives, reinforcing the existence of multiple realities. The dual approach further suggests that while members of Maola fundamentally agree on the value of using technology, there are multiple realities and understandings regarding the adoption and use of the Leola prototype, and these multiple perspectives could enable or hinder the adoption of digital technologies. Furthermore, for any technological innovation aiming to support or enhance collectively owned processes, the youth need to be critical stakeholders to bridge intergenerational and knowledge gaps. Although the older generation comprises the core members of Maola, the data suggests that some groups consist of a mixture of ages (an intergenerational mix). Moreover, in the newly formed settlements, members of Maola are predominantly Generation X and millennials.[17] Therefore, while the youth might not be directly involved in Leola, they are critical stakeholders because some who decide to settle in the village will eventually become members of Leola when they become homeowners. Understanding the process and retrieving the knowledge for the future is critical for preserving the institutional memory of Leola. Additionally, exposure to the Leola process could contribute to strengthening or improving efficiencies through digital technologies. Therefore, the continuity of the Leola funeral scheme from generation to generation suggests that digitalising the process could be inevitable as the community gradually integrates digital technologies into funeral proceedings.

b Decentralised decision-making in tech adoption and use

The findings under this theme highlight the value of co-creation with communities and the importance of collective ownership. Unlike normative modes of knowledge production, African knowledge production integrates collective insights drawn from experiences. Consequently, knowledge production in the African context is a social construct

[17] Generation X was born between 1965 and 1980, while the millennial generation was born between 1981 and 1996.

rooted in the experiences of those involved in the learning process. Therefore, knowledge is experiential and part of collective responsibility. To maintain the credibility of Leola and the trust level, the older members of Leola did not support the immediate rollout of the app, indicating that its adoption and use would depend on the collective buy-in of the members of the Maola group. Members viewed their role as imparting knowledge and consulting with broader members of the Maola group. Batho ba Bagolo emphasised that their mandate is to consult with broader members, while groups with high readiness in piloting the prototype did not see the need for further consultation if the prototype was not going to replace their manual process.

The respondents believed that the dual approach would allow for a gradual transition and adoption of the digital solution while accommodating the concerns of those who might be hesitant or lack the necessary digital skills. The recommendation by the Maola representatives reflects an understanding of the diverse perspectives, collective buy-in and readiness for technology adoption, while acknowledging the importance of maintaining the collectivist principles that govern the Leola process. Moreover, the collectivist approach demonstrates that decision-making in the MTA community is a decentralised process irrespective of one's position in a group. The Maola representatives who participated in developing and testing the Leola prototype are executive committee members. Despite their role and standing in the community, they do not view their decisions and support of the prototype as final and compulsory for their members. Moreover, their consultative approach indicates that meaning making is a group process, while collective understanding is a critical step in ensuring the acceptance and use of the Leola prototype. The collective decision-making process extends beyond consultation. It encompasses the understanding that technology adoption is not one-size-fits-all. This implies the need for policymakers, innovators, and researchers to ground contextual innovation within established communal processes to secure collective buy-in by ensuring that the interventions represent diverse voices and aspirations. Moreover, understanding the cyclical and decentralised decision-making influence on adoption and use is vital. Consequently, the iterative process suggests that technological innovations require a long-term approach rather than project management-bound timeframes.

In conclusion, the Leola case study highlights the potential of digitalising culturally embedded and collectively owned cultural practices. The findings demonstrate the role of non-digital innovations as catalysts to facilitate DT.

8.3.2 Digital aspirations: Agri-tech

The agri-tech case study explored how farmers could utilise digital technologies to advance their aspirations, integrating traditional and modern farming methods. The data suggests that migration, the influence of Eurocentric ways of living, and the democratic dispensation have alienated people from practising their culture and have disrupted farming activities. However, in recent times, there has been a cultural shift among Generation X and millennials, as evidenced by the case of Batau Farming. The findings from Batau Farming demonstrate the value of cultural and traditional knowledge transfer between generations, as captured by the proverb "Rutang bana ditaola, le se ye le tšona badimong" (the intentional transfer of wisdom, knowledge, and skills to the younger generation).

a Philosophical underpinnings of contextual non-digital innovation

In the case of Batau, the use of cow dung (known as Mmutela) resulted in an integrated ecosystem that connects farming, livestock management, and environmental care. This integration further unlocks a multifaceted value chain with tangible benefits for the farmer, the household, the cows, and the environment, exemplifying how the NTU cosmic forces are interconnected with the farming process presented in Table 8.2.

Table 8.2: Interplay between farming processes and the NTU cosmic forces: The case of Batau Farming

Examples of interconnected entities in the farming ecosystem (the case of Batau Farming)	NTU beings
Farmer and livestock owner	Mu-NTU/Ba-NTU or Batho
Household	Ha-NTU temporal space and time
Livestock / cows	Ki-NTU that cannot think on its own
Kraal	Ki-NTU (intersecting with Ha-NTU, land ownership and spirituality, as observed by Banda and Van der Merwe (2017))
Environmental care (safety of livestock; processing and application of the cow dung on Batau's crops)	Ku-NTU (the quality of the kraal) Ku-NTU (enabling the livestock to be without constraints) Ku-NTU (the ability of Mu-NTU and the livestock to co-exist in a healthy and clean environment)

Note: The table illustrates the interconnectedness of farming processes with the NTU cosmic forces and the relationships between different elements.

The interconnectedness of the African thought system means that innovators must first seek to understand the philosophical underpinnings of cultural processes and practices before embarking on digitisation and digitalisation. This approach could prevent reductionism and the oversimplification of the thought processes concerning specific cultural practices. Thus, when designing digital technologies, prioritising the understanding of contextual philosophies over functionality is crucial. This finding aligns with the African worldview on ontology and various forms of reality, namely perceptual, symbolic, and intra-active. For instance, in the farming process, different forms of reality converge. In the case of Batau Farming, the convergence of realities is reflected by the interplay between farming activities, the wellbeing of the livestock, land management, and the use of cow dung as fertiliser. The lived reality is that cow dung is a valuable resource, rich in nitrogen.

On the other hand, the value that Batau Farming attaches to cow dung is symbolic of the wisdom of the Batho ba Bagolo. Intra-active reality is exemplified by the dynamic interactions and symbiotic relationship between farmers,

livestock, households, kraals, and environmental care in the Batau Farming system. Consequently, the narratives of Batau Farming outputs and the profit generated are not only symbolic of sound farming practices, but reflect the convergence of realities, as perceived by Batau and the symbiotic relationship between the NTU cosmic forces presented in Table 7. This finding implies that for innovators who seek to introduce digital innovations in Batau Farming, focusing solely on tangible outputs like crop quality and profits generated may lead to a clash of worldviews or the oversimplification of farming practices. Therefore, digitalisation and automation should consider retaining the coexistence of the elements rather than separating them solely for the sake of tangible manifestations.

One of the research respondents characterised such oversimplification as the "black box" approach. The approach implies that an etic approach to digitalising and automating processes entwined with spirituality, expressed as moya (spirit), can never fully cater to the needs of the people, as there will always be a knowledge gap. The case of Batau provides insights for innovators to go beyond the symbolic and material manifestations by co-creating with the farmers and communities to fully understand the philosophical foundation of cultural practices and processes.
The interconnectedness and holistic farming approach by Batau, as well as the integration of cultural practices into modern farming, provide insights into the importance of understanding the epistemic and ontological aspects that underpin contextual innovation. The findings indicate that Batau's approach promotes multiple uses of resources. For example, applying cow dung enhances farming yields and maximises profit, contributes to the well-being of the cows, and addresses the needs of cattle owners while creating income-generation opportunities for kraal cleaners.

The holistic approach contributes to land care, with the potential for additional uses such as energy generation. The multiple-use approach aligns with the interconnectivity and the integrated nature of the Leola funeral scheme as a multipurpose platform. The findings reinforce the inseparability of Mu-NTU from non-intelligent beings and the importance of tailoring digital technology solutions to align with communal thought systems. For instance, Batau's thinking system is based on the principles of holism and interconnectivity exemplified by the symbiotic relationship between the farming processes, land, livestock, households, and the environment.

b Existing capabilities and innovative mindset

Batau's farming practices indicate that farmers in resource-constrained environments can adhere to farming standards without relying on digital technologies and applications. For instance, Batau collects daily data, including weather monitoring, as part of its strategy for improving business and total quality management. The data collected by Batau includes critical information about the timing and execution of various activities such as weeding, the application of fertilisers and pesticides, tracking rainfall, planting, yields, and profit estimations. Furthermore, the findings indicate that, in Batau's case, the collected data informs decision-making processes, demonstrating that farmers in resource-constrained environments are adapting to meet global standards, even though they have limited digital resources and skills. Batau's preference for manual data entry, even though Batau owns a laptop, underscores the practical challenges of incorporating technology into existing workflows. The data shows that digital or non-digital technology must assist people in solving problems and advancing their aspirations.

The data from Batau's farming practices further supports the perspective that technology, as a tool, should not exist for its own sake but should serve multiple purposes and adapt to the unique environment and people's aspirations. Despite owning a laptop, he relies on manual data-capturing processes using books. This highlights the necessity for technology to seamlessly integrate into existing workflows, aligning with Muvhanga's concept of technology as nzira, a way of accomplishing tasks. Thus, technology should not be an end but a means to adapt to users' specific circumstances. This finding emphasises the need for innovators to ensure that digitalisation efforts are not perceived as an added burden. Therefore, digital technologies must integrate seamlessly with existing farming processes and improve efficiency.

The insights from the case study of Batau Farming challenge prevailing stereotypes about rural innovation and reveal the untapped potential for agri-tech in resource-constrained environments. Although the study did not develop a prototype solution for agri-tech, Batau's aspirations provide valuable insights into the potential of digitising and automating farming processes. In contrast to narratives that rural communities are lagging behind their urban counterparts regarding innovation, despite limited access to digital infrastructure, localised digital applications, and skills, farmers can engage in non-digital agri-tech innovations. Furthermore, resource-constrained environments such as the MTA demonstrate prevailing innovative practices and entrepreneurial mindsets, showing the potential for agri-tech adoption and adaptation. This finding suggests a gap between policy aspirations and people's daily realities. For instance, while it might be true that rural youth require capacity-building, the case study of Batau challenges common stereotypes and assumptions about the capabilities of rural youth. Highlighting the need to understand innovation in resource-constrained settings, including mapping existing capabilities and knowledge gaps, rather than one-size-fits-all approaches and generalisations. Furthermore, while the case study demonstrates the potential for integrating technology and collaborative farming methods driven by data analytics, the competitive environment and lack of trust among farmers in the MTA may pose challenges to implementing the conceptual solutions. Therefore, it is crucial to implement mind mobilisation interventions supported by ongoing change management strategies to address the prevailing scarcity mentality that limits expanding existing capabilities.

In conclusion, the exploration of the agri-tech conceptual case study emphasises the crucial need for the integration of traditional farming practices with modern innovations to facilitate contextual digital innovation. Moreover, the findings suggest that for agri-tech to be relevant and successful, it needs to fit into existing farming practices and integrate seamlessly with existing manual workflows.

8.3.3 Digital possessions: E- cultural heritage

The Bohwa bja rena (our inheritance) case study provides insights into how digital technologies could address the challenges of cultural heritage knowledge loss and facilitate intergenerational knowledge transfer. Isa et al. (2018) observed that people are still unaware of the importance of preserving heritage, especially intangible assets. In contrast, a critical need for intergenerational learning and cultural heritage preservation in the MTA is evident.

a Cultural perceptivity, adaptation and intergenerational knowledge transfer

The results reveal that CKSPPs experience adaptation and knowledge loss and go through reclamation phases. For instance, some of the respondents shared their perspectives on CKSPPs using the past, present, and future tenses, demonstrating dynamism and continuity. The findings suggest that the evolution of culture is an essential process in shaping innovation and addressing contextual challenges. The evolution process aligns with Pahl-Wostl et al.'s (2008) explanation of the adaptation of cultural frameworks as perceptivity. For instance, while Letšema is one of the deeply embedded practices in the MTA, the study found that the application and use of Letšema have evolved. In the past, the community relied on Letšema to attain their sustenance rooted in agricultural activities, promoting the value of reciprocity. Recently there has been a decline in Letšema in the farming community. The evolution of Letšema indicates the adaptability of cultural practices.

Similarly, Mandhwane has undergone a transformative process, adapting to changing cultural dynamics and external influences such as Christianity, while still retaining its core principles of practical learning. Beyond losing cultural memory, the study found that, in the MTA, there is a decline in language proficiency. The respondents highlighted that the decline of the language and the erosion of other cultural practices is due to broader societal transformations brought about by the democratic dispensation. For example, the study found that replacing profound cultural expressions, like addressing children by their clan names, with phrases such as "My boy" or "My girl" demonstrates a lack of understanding about the importance of language in preserving cultural memory and serving as a tool that intersects the past, present and future, shaping identity and fostering social cohesion. Therefore, language is a multifaceted system that shapes psychological well-being, behaviour correction, motivation, and punishment aspects expressed through songs, proverbs, and idioms. It is a non-digital tool that encodes, encrypts, and preserves data, information and knowledge to be decoded by future generations. Consequently, the decline of language proficiency implies that there is a loss of historical data, information, wisdom, and skills in communities such as the MTA.

In the MTA, the community calendar reflects the connection between cultural heritage practices, educational, economic, and agricultural activities, and their adaptability to environmental changes. The data also shows the difference between traditional farming and modern farming seasons. The respondents emphasised that modern farmers work in two seasons (planting and harvesting) and that the pursuit of generating income drives their farming activities. Consequently, the farming process does not integrate into the communal ways of living. In contrast, the traditional farming seasons integrate the processes into the daily life cycle, including environmental changes. The calendar demonstrates a link between agricultural activities, the household food system, and life events such as initiations, religion, rituals, death, celebrations, and the impact of migration, among other things. Understanding the relationship between community activities and the seasons offers crucial insights to inform contextual innovation strategies.

Moreover, the data supports the mind mobilisation strategy applied by Khumbane, who used daily weather monitoring (household calendar), incorporating it with the African calendar as a tool for planning and knowledge preservation, as observed by Hart and Baiphethi (2008), de Lange et al. (2009), Goldin and Gordon (2010), and

Magoro and Bidwell (2022). As evidenced by Batau, the daily weather documentation informs the decision-making process and serves as a repository of cultural narratives of Mmutela in the agricultural value chain, the intersection of modern and traditional farming processes. The study suggests that digitised community-based seasonal calendars could serve as a knowledge management and educational tool to promote intergenerational knowledge-sharing and preservation.

The data suggests that communities such as the MTA transfer knowledge through communal and clan processes. Specifically, clan events such as Aretsebaneng (family gatherings) serve as platforms to transmit collective wisdom to the younger generation to ensure continuity. For example, in the MTA, family gatherings and burial societies play a significant role in preserving the clan's history and rituals. Culturally embedded practices could facilitate inclusive digital adoption and use by documenting family trees and establishing a database of clan names and praise songs. From an epistemic perspective, children play a crucial role in the cultural heritage value chain as they serve as the link between the past, the present, and the future. Therefore, the transfer of cultural knowledge is a shared responsibility, with children serving as active actors in this process. In the MTA, children actively engage in the retrieval and preservation of their heritage, driven by the celebration of Heritage Month and the school curriculum. For instance, while children may not actively engage in specific cultural practices, having a deep understanding of their culture is crucial, as cultural heritage reclamation and preservation establish the foundation for innovation.

In the MTA, some youths are aware of the value of their cultural heritage, the potential for income generation, and the possibility of exploitation by external actors. Therefore, there is a need to support knowledge producers in protecting their intellectual property (IP) and exploring avenues for commercialising their knowledge. In contrast to the tension around IP, an older woman who is a crafter expressed excitement about using technology to advertise her products, and even suggested that she would be willing to pay content curators if they could help her to sell her products, on condition that she would still be in control of her products. The findings suggest that her readiness to engage in online selling, coupled with her insistence on maintaining control over her products, showcases her understanding of possible unethical behaviour associated with IP. Furthermore, effective e-commerce integration based on cultural heritage necessitates the development of policies safeguarding communities from extractive processes facilitated by digital technologies.

b Funeral-tech economy: Blending death, spirituality, and technology

In addition to preserving cultural heritage, the study found that there is an emerging digital entrepreneurship ecosystem in the funeral economy. For example, some families integrate digital technologies into the funeral services to create content (they share and preserve the funeral proceedings). Funeral activities include the hiring of digital devices such as projectors and plasma screens to display the life journey of the deceased. Consequently, the digitalisation of funeral services has led to the creation of digital entrepreneurship. The emergence of digital entrepreneurship in the funeral economy demonstrates the adaptability of cultural practices in the digital age. Furthermore, this study suggests that the intersection of the funeral economy and digital entrepreneurship could

unlock opportunities for innovation interconnected with spirituality. The findings indicate that the uptake and use of digital technologies as part of the funeral proceedings are linked to the local cultural framework, which honours the deceased by ensuring that they are "buried in dignity" or "o bolokegile"[18] in the local expression. The local expression of "o bolokegile" is aligned with the aspiration of a dignified send-off and the belief that the departed have agency as they transition into a new role of spiritual guidance, protection, and offering blessings to the living and people who are still to be born.

The interplay between digital entrepreneurship and the funeral economy highlights the multidimensional relevance of technology in the community of Mamaila. However, due to the lack of localised sharing platforms, people use social media and WhatsApp to store and share their content. In some cases, people lose their digital assets as they are stored on USBs, discs, computers, and social media. This implies that eventually, they lose both the spiritual meaning attached to the digitalised content and the investment made in the creation of the content. In some instances, the devices become incompatible with the latest technologies. Therefore, the findings suggest the need to deploy digital applications and infrastructure that promote the preservation and future retrieval of digital assets. Furthermore, the Leola funeral scheme prototype and the agri-tech solution demonstrate the potential of Letšema big data analytics in creating digital local economies (see Appendix S). Contextual digital technologies, such as knowledge management systems, marketplaces, and seasonal calendars, could play a crucial role in generating data and connecting farmers, households, Maola, and children within the localised DKE.

In response to the research sub-question on *how a culturally embedded approach can facilitate inclusive digital adoption and use for rural socio-economic aspirations*, the study found that spirituality and identity contribute to inclusive digital adoption. However, mainstream digital technologies and applications do not always align with the day-to-day activities of communities like the MTA. Instead, they primarily enable transactional activities that are individualistic and promote consumerism. Additionally, the study found emerging digital entrepreneurs in the funeral sector challenging the perception that communities are passive beneficiaries and consumers of digital solutions. In conclusion, the findings suggest that there is potential to harness big data analytics to visualise communal processes and unlock the local economic value chains intersecting cultural heritage, agriculture, financial services, and the funeral economy.

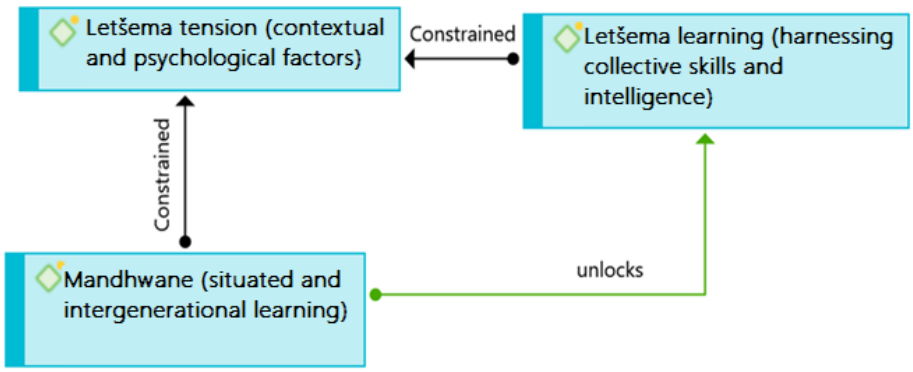
8.4 Intergenerational digital learning and innovation

In this dimension, I examine how culturally embedded knowledge systems facilitate the development of digital skills for active and inclusive participation in DT by African rural communities. The previous dimensions indicate that knowledge and skills development in African societies are holistic, communal, and rooted in lived experiences. The case studies of the Leola funeral scheme and Bohwa bja rena prototypes indicate that fear, tension, multiple realities,

[18] This implies that one was properly buried according to the village standard, and, in some cases, the standard was exceeded.

and psychological factors play pivotal roles in shaping collective understandings and learning experiences in the community. The findings suggest that learning is a dynamic process that does not separate learning and knowing from collective actions. Emotional and psychological factors are also integral to the learning process, as shown in Figure 8.5.

Figure 8-5: Intergenerational and contextual learning



Note: This Atlas.ti figure illustrates three key themes emerging from the data analyses: Mandhwane (situated and intergenerational learning), Letšema learning (harnessing collective skills and intelligence), and Letšema tension (contextual and psychological factors).

8.4.1 Mandhwane situated and intergenerational learning

The findings suggest that embedding digital skills development in cultural contexts and integrating them into existing contextual systems and structures of innovation are crucial for contextual DT. Additionally, contextual innovation is an outcome of communal effort, co-created and co-designed with the communities, grounded in contextual realities. Moreover, contrary to dominant narratives portraying Bagolo as passive consumers of technology, this study highlights that older people play an active role in shaping contextual technological innovation when given an opportunity to do so. Despite their limited digital skills, the executive members of the Maola groups contributed to the co-creation of the prototype of the Leola funeral scheme. For instance, the executive members collectively peer-reviewed and validated the Leola business processes and identified potential areas that could be digitalised. This finding is consistent with Haase et al. (2021), who observed that co-creating technologies with older adults can enhance technology engagement. Furthermore, Batho ba Bagolo identified areas of vulnerabilities that could emanate from digitalising the Leola process, demonstrating that although they might lack the skills to navigate the prototype, they possess the contextual skills critical for 21st-century digital skills, as discussed by van Laar et al. (2017).

The study suggests that situated learning acknowledges and affirms existing community knowledge and skills regardless of one's digital skills, possessions, assets, or lack thereof. For instance, in this study, participants included individuals ranging from Batho ba Bagolo up to the age of 73 and youth aged 23 and above, who collaborated in the co-creation of the Leola prototype. This underscores the importance of both intergenerational and multigenerational diversity in co-creation processes and the transfer of digital skills. Moreover, while Generation Z does not actively participate in the Leola process (unless they already have households of their own), they are aware of the funeral

scheme. Their level of awareness indicates that knowledge and knowing result from social interaction. This finding aligns with the view shared by one of the respondents, highlighting that, in the Basotho ontology, true knowledge is the knowledge that is encoded in the chromosomes and reinforced through "breastfeeding", implying that knowing for African children is not the output of the Western or conventional schooling system, but an embodiment of their lived experiences. The lived experiences are shaped by the environment and their interconnectedness with their homes and broader community. Moreover, Batho ba Bagolo views children (Generation Z and Alpha) as the future custodians of knowledge. According to older people, children must learn about their cultural heritage and use digital applications to preserve their knowledge. In the context of this study, children actively reclaim cultural practices such as Sekhapa music and recite clan praise songs.

The data suggests that digital skills should be conducted as a socialisation process to prepare children for their prospective roles in the DKE. Furthermore, the dialogue between the different generations contributes to determining the digital aspirations and the factors that could inhibit adoption and use. Therefore, this study suggests the need to create opportunities that bring together different generations to explore the role of digital technologies in Han-NTU (temporal space for innovation) by exploring contextual learning strategies that incorporate everyday concepts and experiences from people's lexicons. ,Unlike short-term and events-based learning approaches, the findings of this study indicate that the development of digital skills for inclusive and active participation necessitates a long-term approach that ensures participants are continually learning. Moreover, there is a need for a paradigm shift to a lifelong learning approach that focuses on contextual problem-solving, grounding the development of digital skills in daily processes. For instance, during the mind mobilisation workshop, participants engaged in a peer review of the Leola process, critically identifying areas for potential improvement, and sharing knowledge and good practices.

The review of the Bohwa bja rena website led to a discourse on preserving cultural heritage and identifying opportunities to use technology for knowledge preservation. As evidenced in the Leola experimentation, engaging communities with unknown or unfamiliar processes, such as the digitalisation of manual processes, can trigger a fear of technology. The lifelong learning approach requires investments in technical and non-technical interventions, such as mentoring, leadership skills, change management, intellectual property management, and the incorporation of enterprising local knowledge guided by ethical frameworks.

8.4.2 Letšema tension (contextual and psychological factors in learning)

The current methods and approaches to digital skills development do not always build on what people know. Thus, there is a focus on transferring digital skills from the unknown to the known, which can lead to individuals developing a negative view of their capabilities. The data indicates that it is crucial to begin digital skills interventions with what individuals already know because this approach provides a foundation in unlocking participation. Additionally, the study found that phrasing digital skills narratives using local lexicons contributes to mental shifts and encourages co-creation, design, and content curation. Therefore, innovators should consider exploring contextual learning strategies that incorporate everyday concepts and experiences from people's lexicons.

In contrast to the potential exploitations and vulnerabilities associated with the Leola prototype, Batho ba Bagolo demonstrated curiosity, enthusiasm, and pride when browsing the Bohwa bja rena website. They expressed a strong desire to access comprehensive cultural information. Furthermore, the data shows that the responses provided by the participants on the heritage website reflect psychological aspects associated with cultural identity and representation. A senior member of the Leola group, who expressed concerns about potential fraud by children in the case of the Leola prototype, demonstrated enthusiasm when engaging with the Bohwa bja rena prototype and described it as an educational tool that could benefit future generations. While having access to digital technologies and training is crucial, the prerequisite for digital skills development is tackling psychological barriers and creating an environment that nurtures confidence and trust among community members. The findings suggest that it is imperative to introduce DT processes by leveraging the strength of the community and then focusing on their knowledge gaps. In the context of the MTA, leveraging cultural heritage, identity, and local community lexicons was the starting point for engaging in DT discourses, contributing to discussions, and actively participating in the development of prototypes. Moreover, the learning-by-doing approach, framed as Mandhwane, enabled knowledge exchange over the provision of technical skills.

In the case of the MTA, situating digital skills activities involved using a cultural heritage approach to facilitate learning and conversations. This non-technical approach created an engaging space for older generations to share knowledge on the operations of the Leola funeral scheme, reaffirming their existing knowledge. The findings suggest that tension and fear in the learning environment influence the nature of learning and its outcomes, regardless of people's levels of Botho. Therefore, it is crucial to move beyond the attributes of Botho as a catalyst for knowledge sharing, skills transfer, and community engagement to holistic approaches that acknowledge how lived experiences and historical legacies shape learning. Although Botho attributes such as kinship serve as a foundational value in facilitating contextual innovation, as observed by Abubakre and Mkansi (2021), the data for this study suggests that Botho is not a static value. Contextual factors and conditions in the learning environment and individual motives determine the effectiveness of learning, irrespective of kinship.

The experimentation from the Leola funeral scheme provides empirical evidence of the potential to co-create digital solutions rooted in local ontologies and epistemologies. The insights drawn from the experiment suggest that even though "Bagolo" (the elders)[19] predominantly manage Leola, the scheme operates as an intergenerational-based platform. Consequently, there is a growing awareness among community members about the potential benefits of integrating technology into the communal process. This demonstrates that while people lack digital skills, there is a readiness to use digital applications to manage culturally embedded practices and processes. Moreover, the data suggests that culturally embedded contextual innovations are not immune to vulnerabilities and exploitations. For instance, although Leola is a highly valued practice, some members of the groups pointed out that the scheme is not without weaknesses and challenges. The findings indicate that, in some cases, the practice experiences unethical

[19] Baby Boomers and Generation X in this study are referred to as "Batho ba Bagolo" (the elders). I use Baby Boomers to emphasise the generational significance.

behaviour and promotes consumerism and extravagant behaviour, especially in the emerging schemes, predominantly led by the younger generations. This finding suggests that non-digital technologies also face potential vulnerabilities and exploitations. Despite the challenges, members of the scheme see the value in leveraging digital solutions to improve management and accounting processes. For instance, the digital solution could enable knowledge-sharing among members and promote adherence to ethical practices and good governance standards.

8.4.3 Letšema digital and lifelong learning – Harnessing collective intelligence

In the context of the MTA, data suggests that people acquire skills through learning by doing and observing, as evidenced by the rapid growth of Maola groups and farming entities. Therefore, adapting digital skills interventions to local conditions and integrating skills transfer into existing communal practices, such as the Leola funeral scheme, have the potential to unlock Letšema learning and harness collective digital intelligence. For example, in the MTA, Leola serves as a platform for transferring financial management knowledge and problem-solving skills for social issues in the community. This implies that there is potential to integrate information-sharing sessions on digital applications (opportunities and challenges) beyond the co-creation of the Leola prototype. Moreover, clan events such as Aretsebaneng (family gatherings) and celebrations of cultural days allow children to learn about their culture. Consequently, the increasing reliance on digital applications for documenting events and sharing content creates an unavoidable intersection between the preservation of cultural heritage and the acquisition of digital skills.
The study suggests that the Letšema digital learning model (see Appendix V) could serve as both a physical and virtual space to harness the collective intelligence, with the agri-tech, heritage, and fintech prototypes forming the foundation for developing contextual digital skills. The model represents a combined knowledge and intergenerational learning ecosystem, composed of community structures such as Leola, farmers, children, and households, while also acknowledging that environmental and psychological factors influence and shape the learning process.

The findings suggest that learning is a dynamic, ongoing process that integrates collective actions with individual learning and knowing. Emotional and psychological factors are also integral to this process. In response to the research sub-question, *To what extent do culturally embedded knowledge systems facilitate the digital skills development required for active participation in the digital economy*?; the study found that intergenerational and contextual learning approaches have the potential to promote inclusive digital skills development and to shape the design and development of digital solutions embedded in the existing non-digital communal innovations. Therefore, there is a need to rethink what learning is, and where and how people learn. The study suggests that learning in African communities is a holistic process deeply grounded in communal knowledge systems and lived experiences.

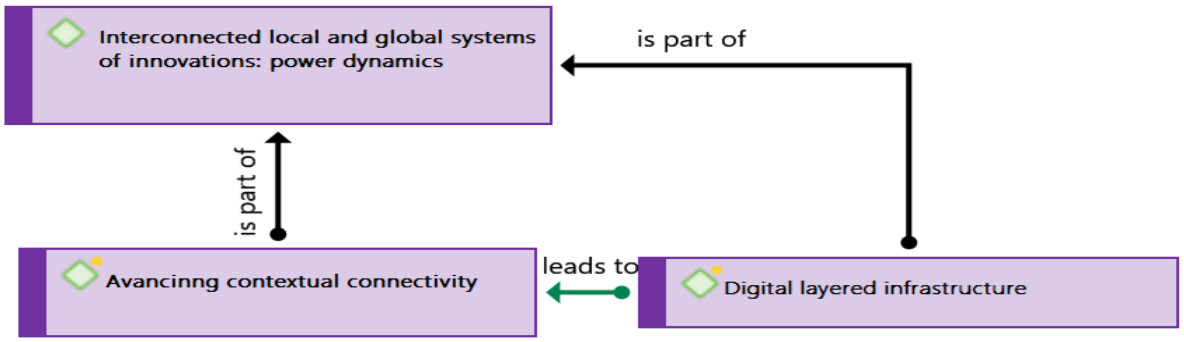
8.5 Batho-centric digital infrastructure

In this dimension, I explore the appropriate digital infrastructure to facilitate the development of localised solutions for inclusive DT in resource-constrained communities. The contextual DKE and innovation dimension highlight the integral role of digital infrastructure in facilitating the inclusive and active participation of communities in DT.

Similarly, the intergenerational digital learning and innovation dimension highlights the importance of digital infrastructure in fostering contextual, situated, and lifelong learning through Letšema digital learning. The data suggests that digital infrastructure encompasses more than just technology. It should integrate with the community's way of life and should support their aspirations. As discussed in the literature review, digital infrastructure is managed by complex processes mainly driven by the pursuit of dominance and profit. Thus, appropriate digital infrastructure in resource-constrained environments requires a holistic approach that considers ways of being, knowing and doing beyond the provision of the Internet and devices.

The findings suggest that focusing solely on easily measurable aspects like the number of people with access to digital devices, connectivity, and e-services might not address deeper systemic factors that shape the nature of contextual DT. For instance, the study found that the power dynamics surrounding the distribution platforms of digital content hinder localisation efforts. Moreover, focusing on the diffusion of digital applications might overlook the non-digital community infrastructure which could unlock the design and development of localised solutions. Striking a balance between the need for digital integration in globally connected innovation systems and the requirements for contextual innovation systems that consider the aspirations of communities is crucially significant, as illustrated in Figure 8.6.

Figure 8-6: The interplay of Letšema, local, and global digital infrastructures



Note: This figure illustrates the complexities of digital infrastructure intersecting the local and global systems of innovation and the need for a holistic approach to advance aspirations through community-centric digital infrastructures.

8.5.1 Advancing contextual connectivity

The data suggests that, while communities such as the MTA aspire to use digital technologies, achieving their aspirations depends on macro-layer interventions that promote connecting to the outside world rather than connecting internally first and breaking into interconnected systems. In South Africa, the absence of digital infrastructure in rural communities is associated with historical legacies, resulting in communities such as the MTA being situated at the periphery of the telecommunications infrastructure. The peripheral location necessitates a reconsideration of the conventional digital infrastructure deployment based on one-size-fits-all approaches. Therefore, the study suggests

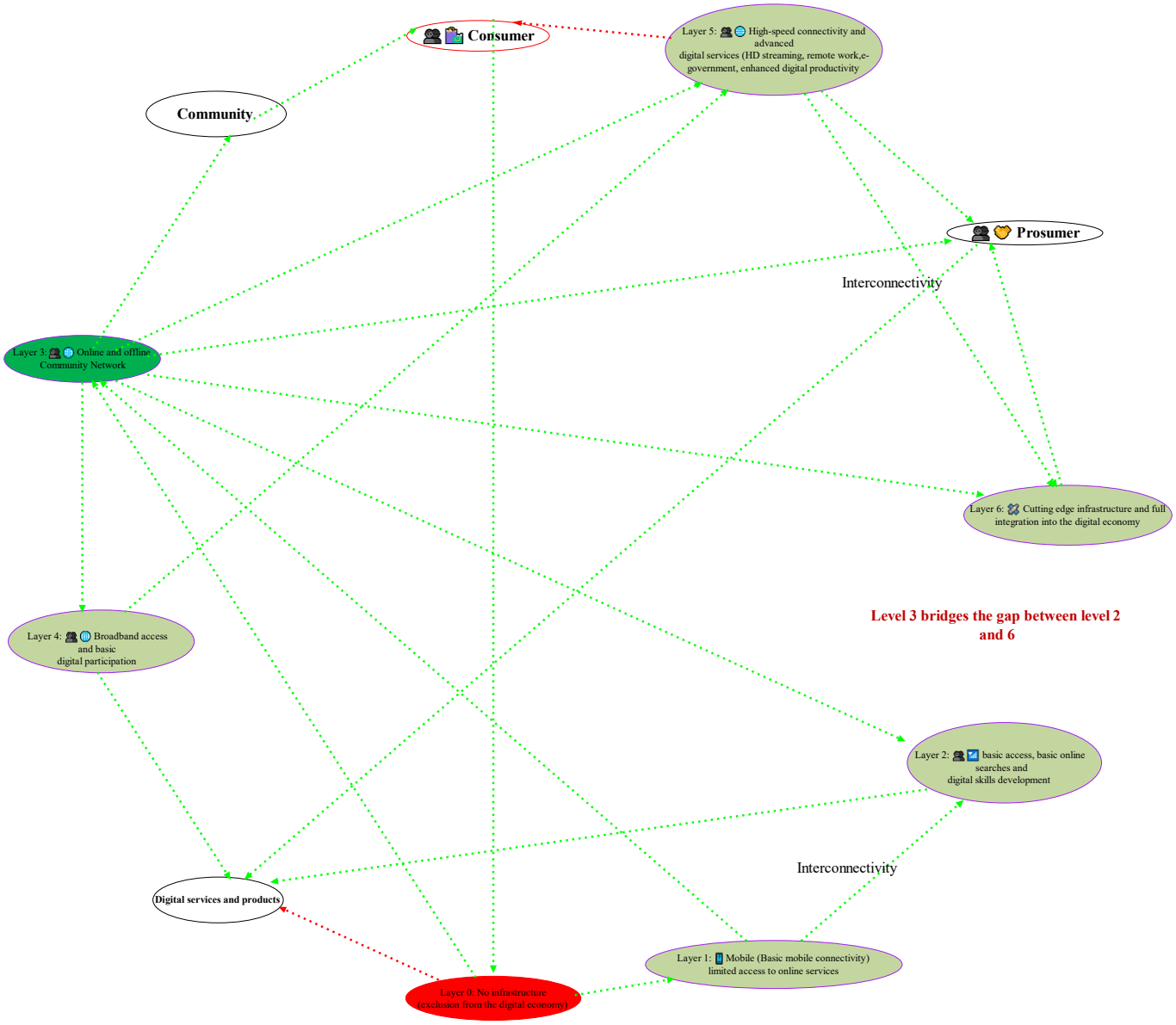
that closing the gap between people's aspirations, infrastructure, and connectivity requires a dual and layered approach.

8.5.2 Layered digital infrastructure

Drawing upon the observations by Johnson et al. (2012), the conceptual layered digital infrastructure[20] approach, illustrated in Figure 8.7, suggests that CNs with their duality of online and offline capabilities could serve as a critical transitional connectivity layer that facilitates the development of localised solutions and connects underserved communities to higher levels of digital inclusion and socio-economic opportunities. Each layer indicates how users engage with digital technologies in the MTA. The data suggests that while expanding broadband infrastructure accessibility is crucial for digital transformation, integrating offline local networks into long-term strategies is equally important. Offline solutions play a role in preparing communities through capacity building, and enabling localisation efforts by developing technical skills, prototyping, and testing their solutions without incurring Internet costs. Thus, the offline strategies could serve as a complementary approach to prepare communities for interconnecting with externally focused online services. Moreover, while Internet access is crucial for meaningful digital transformation, a paradigm shift from Internet-centric approaches to hybrid approaches that integrate online, and offline solutions is imperative. The suggested shift could nurture an ecosystem to enable local networks to localise digital activities and data. The description below provides insights into the aspirations of the South African government's digital infrastructure strategy compared to the lived realities of communities, as observed in the case of the MTA, and the potential for the suggested dual and layered approach in closing the infrastructure divide.

[20] A gradual approach in advancing digital connectivity.

Figure 8-7: The conceptual layered digital infrastructure



Note: This figure illustrates a layered and dual approach to the development of digital infrastructure. Each layer represents a step in advancing connectivity and capabilities, ranging from exclusion due to the absence of infrastructure to full integration into the digital knowledge economy. Source: Author, 2024.

The data for this study indicates that there **are multiple realities** and approaches to digital infrastructure. Moreover, in an African context, digital infrastructure must reflect multiple realities instead of the linear and one-size-fits-all approaches to digital development. The layered digital infrastructure could serve as a tool to guide the development of digital infrastructure that aligns with the African thought system to enable collectivist aspirations and multiple uses of technology. Additionally, while the dominant narrative is that communities need access to cutting-edge connectivity and full integration into the DKE, another reality is that spatial, economic, and geographic disparities hinder the realisation of these popular narratives. Instead of passively waiting for Utopia, the study recommends adopting a proactive and progressive approach to achieve the desired state.

8.5.3 Digital integration globally connected systems and power dynamics in digital infrastructure

The South African policy and regulatory ecosystem aims for meaningful and active participation in the global knowledge economy and innovation systems. Despite these aspirations, the findings suggest that digital infrastructure does not only grant access to digital products, but could also be a tool of extraction, reinforcing the dominance of powerful nations and oligopolies. For instance, the South African PC4IR report highlights that the control exerted by multinational platforms hampers local innovation efforts and full participation in global innovation systems. Moreover, the power dynamics discussed in the PC4IR report regarding the distribution platforms mirror the real-life experiences of the African digital innovators who were part of this research.

As reported by digital innovators creating African-inspired content, some of the intended audiences do not always have Gmail accounts, which are required to install apps via Google Play. Similarly, iPhone users face limitations when installing locally developed apps, as exemplified by the experimentation with the Leola funeral scheme prototype, which was designed for Android devices. Additionally, while innovators must strike a balance between iOS and Android platforms, they must also consider solutions for SMS platforms to cater for local preferences and to reach a wider audience without access to smartphones and connectivity. The lived experiences of African innovators provide insights into broader systemic issues in local and global digital infrastructure and systems of innovations hindering inclusive participation in contextual innovation. However, despite the limitations, African innovators demonstrate “resilience in overcoming adversity and complexity in innovation environments”, as Abrahams (2020) has observed.

The findings indicate that the influence and control exerted by multinational platforms affect various aspects of society at the macro-, meso-, and micro-levels. Therefore, given the challenges highlighted by the PC4IR report and the lived experiences expressed by African innovators, the study suggests a need for a policy and regulatory environment that enables cross-platform compatibility and promotes localisation, while pursuing full integration and competitive participation in the global systems of innovation. Additionally, the study found a significant demand for localised content and language representation in the digital infrastructure context, with respondents emphasising that digital platforms and websites should be available in local languages. Therefore, incorporating local languages into machine learning models and translation systems, and investment in natural language models (NLPs) are crucial.

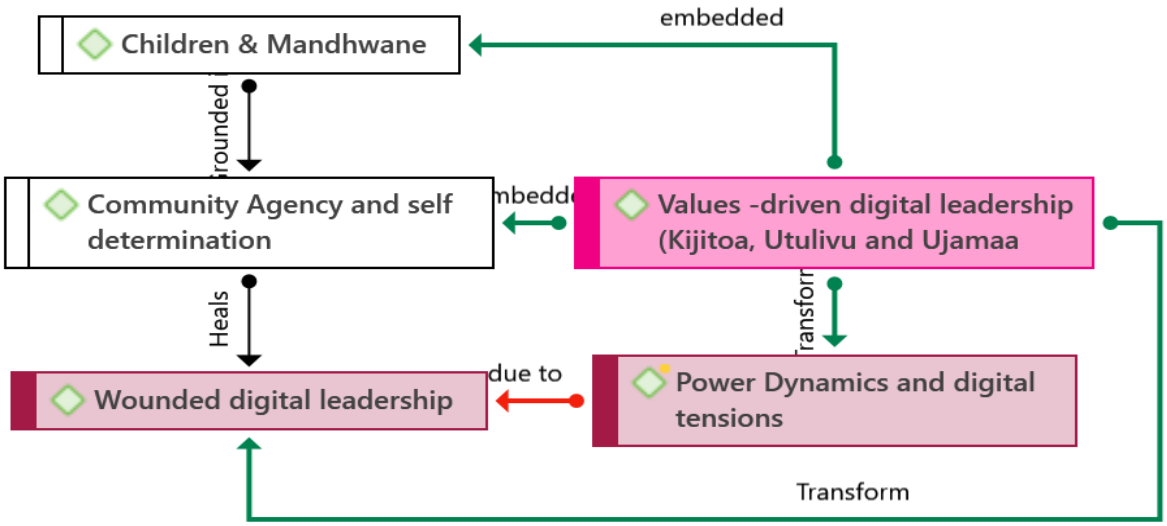
In response to the research sub-question *What is the appropriate digital infrastructure to facilitate the development of localised solutions for inclusive DT?*, the study found that digital infrastructure includes more than just tangible devices and equipment. It also involves various social, psychological, political, and economic factors, as well as global telecommunications systems. These interconnected systems and processes, involving both humans and non-human entities, are often influenced by the desire for power and the maximisation of profits. However, there are opportunities to deploy localised digital infrastructure such as CNs to unlock the potential for the Letšema big data revolution and to promote local value chains. In conclusion, the findings highlight the complexity of digital infrastructure development and emphasise the need for policymakers to adopt dual, hybrid, and context-specific strategies to balance the need for global integration in the digital economy with a focus on building local digital infrastructure.

8.6 Digital leadership in transition

The previous discussions on the dimensions of CKSPPs, the contextual DKE, innovation, intergenerational digital learning, and Batho-centric digital infrastructure highlight the complexity and interconnectedness of the DT. These dimensions indicate the absence of digital infrastructure (connectivity, devices, applications, and local content) and digital skills for communities in resource-constrained environments. Moreover, the dimensions highlight the exclusion of African ontologies and epistemologies, while power dynamics hinder contextual DT efforts. Furthermore, the discussion in this section suggests the presence of dysfunctional and wounded leadership, as illustrated in Figure 8.8.

The findings indicate that while the lack of infrastructure and the lack of skills are factors hindering contextual DT, the wounded and dysfunctional leadership afflicted by historical traumas such as colonialism and apartheid shapes the nature of the ecosystem. Therefore, the study suggests that power dynamics and a wounded mindset could lead to feelings of inferiority or superiority, self-devaluation, and dysfunctional leadership. This may result in the provision of wounded solutions, reflective of the leadership which is disconnected from the day-to-day realities of the communities. Despite such dysfunctional and wounded leadership, this study suggests that a commitment to values-driven digital leadership could facilitate a transformative and people-centred approach to contextual DT and innovation. The transformative approach emphasises the agency of micro-level actors, investing in forward-looking lifelong and experiential learning pedagogies such as Mandhwane. The goal is for leadership to create transformative environments that nurture innovative mindsets in children and embed ethical leadership, guided by the Afrocentric canons of ukweli, kujitoa, utulivu, uhaki, and ujamaa.

Figure 8-8: The intersection of the past, present, and future: Historical legacies and digital leadership



Note: This Atlas.ti figure illustrates the interplay between wounded leadership, power dynamics emanating from historical legacies, and the role of values-driven digital leadership in facilitating transformative and people-centred DT.

8.6.1 Wounded digital leadership and power dynamics (macro-, meso- and micro-level entanglements)

The findings suggest that advocating for global or universals may result in disconnecting leaders from the realities and daily experiences of communities due to their inability to thoroughly examine how historical legacies shape the digital ecosystem. For instance, while initiatives like #LeaveNoneBehind are critical in mobilising collective action, actors in the digital ecosystem might overlook practical needs and contextual aspirations by focusing on attaining universal goals and benchmarks. To illustrate the disconnect between leaders and citizens, one respondent emphasised that some policymakers perceive rural areas to be a curse. Consequently, they do not prioritise providing digital infrastructure and reliable Internet to rural areas. On the other hand, there is a push for the 4IR and attaining global benchmarks, despite the contextual realities that indicate the lack of readiness and inclusivity. The study suggests that the disconnect reflects the coloniality of leaders and unconsciously wounded leadership. Therefore, there is a need to understand that slogans and idealistic goals alone cannot bring about meaningful change. Practical barriers, such as a lack of energy and connectivity, which hinder the inclusion of rural communities in the digital ecosystem, need to be tackled.

Moreover, unlike unconsciously wounded leadership, even individuals aware of historical legacies and digital disparities may make decisions that perpetuate existing inequalities. Data from this study shows that meso-level actors often contribute to exclusive DT, due to their focus on supply-driven interventions, a lack of systems thinking, and prioritising meeting the expectations of macro-level actors. In some cases, personal ambitions take precedence over contextual realities. While acknowledging the need for critical success factors such as skills, infrastructure, relevant content, and software in DT, some respondents pointed out that implementing isolated pockets of DT without considering these factors often reflects a prioritisation of personal agendas and institutional mandates over the lived

realities of the community. As a result, micro-level actors become entangled with meso-level actors, who are entangled with the unrealistic expectations of macro-level actors. These macro-level actors often prioritise quantitative metrics over qualitative outcomes. This study suggests that these entanglements and the coloniality of being emanating from historical legacies result in the replication of power dynamics. Furthermore, the findings suggest that the diffusion of pre-installed digital applications, such as gambling, without putting measures in place to protect users, demonstrates acts of dysfunctional and wounded leadership that consciously or unconsciously perpetuate adverse digital incorporation, as observed by Heeks (2022). In the context of this study, an example is local or informal gambling activities such as Mochaina (see Figure 41: Main economic activities in the MTA). Traditional gambling and card games are integral components of the MTA's economic and financial sector, despite their illegality. Moreover, Mochaina (Mo-Chaina) indicates the origin, ownership, and control of the concept by Chinese people, as observed by Louw (2017). Mochaina, while also extracting money from communities, it is a collectivist gambling activity that depends on the cooperation and participation of peers in the same location.

The recent diffusion of instant and individualised gambling applications has the potential to create multiple vulnerabilities in communities such as the MTA due to their always-on mode, which is also linked to instant and digital financial transactions. This means that online gambling is accessible 24 hours a day. As a result, instant gambling might deplete individuals' finances and expose them to new vulnerabilities, including round-the-clock gambling dependencies, unlike conventional or localised systems. This finding means that digital leadership must critically examine the impact of digital technologies on local economies and social well-being to mitigate unconscious digital colonisation and the perpetuation of adverse digital incorporation. "Informal gambling in Africa constitutes an important part of everyday life, in all its banality. It is a medium through which individuals enter into relationships with each other, form communities, share hopes and dreams, have fun, and develop autonomous competing conceptions of the good life" (Louw, 2017, p. 21).

While the research did not study the effectiveness of community structures in the MTA, the findings suggest that the community demonstrates self-determination exemplified by the establishment of structures such as Maola funeral schemes. However, community leaders in the MTA believe that while the community collaborates in structures such as Maola, there is a lack of intentionality in unlocking collective capabilities to expand local economic aspirations. According to the leaders, the lack of support is partly due to a general lack of trust in local products and the capabilities of fellow community members to run successful businesses. This observation by community leaders aligns with the views shared by the macro- and meso-level respondents, who pointed out that, at the micro-level, the consumer mindset is wired to prefer products and services from other geographic areas rather than homegrown solutions, and this is partly influenced by historical factors. For example, community leaders in the MTA expressed concerns that community members view themselves and others as incapable, resulting in the devaluation of locally led solutions. Moreover, the community leaders attributed the inferiority complex to historical legacies that have conditioned Africans to devalue themselves. In addition, contrary to the common belief that development initiatives fail when led by outsiders, data from the MTA suggests that interventions driven by outsiders, particularly individuals from different racial backgrounds, have a better chance of success. The finding on the lack of support for locally

owned businesses aligns with what Krige and Krige (1943) observed in the Balobedu culture. Balobedu people prioritise collective well-being over individual gains. Although the observation by Krige and Krige (1943) did not specifically consider the link between technological advancements and collective capabilities, it offers valuable insights for people-centred and contextual DT and innovation initiatives in the Balobedu context.

Therefore, innovators must exercise caution and sensitivity, as there are aspects in communities that require sensitive handling. Moreover, the data suggests that, in some cases, community interventions experience internal tensions and conflicts due to power struggles, resulting in disputes over governance control and competition for limited resources in communities. DT interventions focus on the individual-level psychological factors hindering technology adoption and use. This study suggests a shift towards the group-level restoration of Batho, focusing on socio-psychological factors and the restoration of self-worth, self-respect, and self-confidence as preliminary steps in mobilising the mind for inclusive and active participation in DT and the DKE. The findings also suggest that mobilising mindsets, investing in education, and empowering communities are prerequisites for community engagement.

8.6.2 Values driven leadership and transformative path to contextual DT

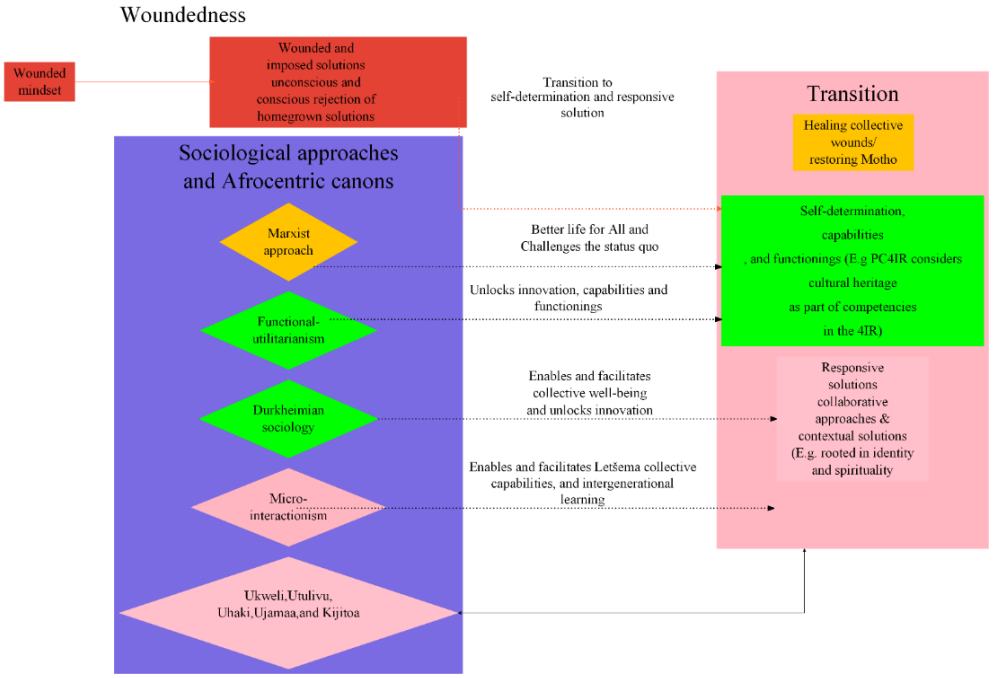
The preceding discussions highlight that digital leaders at all levels have the agency to facilitate or contribute to people-centred, transformative, or exploitative DT shaped by and influenced by sociological lenses, as observed by Jackson et al. (2021). The study found that the South African policy and regulatory environment embodies aspirations for people-centred DT. Additionally, the government recognises the role of cultural heritage as an input in innovation and socio-economic development, specifically in the creative industry. Moreover, the data suggests that despite the silo approaches evidenced by the multiplicity of government entities responsible for different aspects of DT, the South African policy and regulatory environment employs a multifaceted approach incorporating the Marxist, functional-utilitarian, and Durkheimian perspectives. The sociological lenses evident in the different documents collectively align with ideals for the democratic government to create a “Better Life for All” and global commitments such as #LeaveNoneBehind.

The data for this study suggests that the South African policy and regulatory frameworks consider cultural heritage as an input in building an inclusive information society. The 2020 National Digital and Future Skills Strategy emphasises a forward-looking approach, highlighting the need to develop digital skills for economic growth and social development. Furthermore, the PC4IR aligns with the Durkheimian sociological lenses, emphasising the need for cultural competencies as part of the digital skill set to actualise the PC4IR aspirations. The functional-utilitarian approach reflected in the National Infrastructure Plan 2050 (NIP2050) emphasises the role of technology in enhancing public services and thus improving the quality of life for South Africans. The Marxist approach seeks to address the rural-urban divide, while the Durkheimian perspective promotes responsive solutions by providing resources such as emergency spectrum during COVID-19 and zero-rated websites. In contrast, the data suggests that there are inadequate measures in place to ensure micro-interactionism to promote citizen-led interventions that recognise the agency of communities in resource-constrained environments. The multiple sociological lenses

employed by the South African government demonstrate an understanding of the need to build a dynamic digital industry ecosystem, as recommended by Hanna (2018). However, despite the multidimensional approach reflected in the policy environment, the data suggests a gap between aspirations at the macro-level and the lived realities of communities at the micro-level. *In addressing the research sub-question on how digital leadership can foster a people-centred digital transformation,* the study found that adopting a citizen-led approach, which recognises the collective intelligence, capabilities, and agency of people in resource-constrained environments, has the potential to unlock inclusive participation. This approach involves investing in children, nurturing innovative mindsets, and instilling ethical digital leadership skills at all levels of the society. Additionally, the study found that the mindset of individuals at the micro level, as consumers of digital applications and technologies, plays a crucial role in recognising and addressing digital entanglements and emerging adversities. In conclusion, the study suggests that transformative digital leadership involves embracing Afrocentric canons as a guiding framework towards inclusive DT in an African context.

Figure 8.9 outlines a pathway for transitioning from collective woundedness to healing collective traumas, enabling leaders to facilitate and participate in a people-centered DT. The figure suggests that employing sociological lenses could empower digital leadership to transition from woundedness to people-centred DT that provides responsive solutions and promotes collaboration and self-determination. Moreover, guided by Afrocentric canons digital leaders could contribute to developing responsive solutions rooted in cultural identity and spirituality and addressing the historical and systemic challenges that have excluded many from the benefits of the digital era.

Figure 8-9: Sociological perspectives and transitional pathways



Note: This figure illustrates a pathway for transitioning from collective woundedness to healing collective trauma. Source: Author, 2024.

The Afrocentric canons discussed below provide an ethical framework to guide leaders at the macro, meso and micro levels in navigating the complexities of the DT ecosystem.

Ukweli (truth): Digital leaders must critically examine the influence of external actors and the dominance of global platforms in shaping the digital ecosystem in South Africa and put measures in place to balance the needs for global integration with local realities. Thus, ukweli could help digital leaders ground contextual DT in the lived experiences of the communities while balancing the integration with global innovation systems. Furthermore, the data suggests that there are multiple realities. Therefore, leaders should strive to incorporate diverse perspectives into the design and implementation of digital infrastructure and applications that support multiple uses, for instance, balancing prosumers and consumerism.

Utulivu (justice): The South African government has put various policies and regulatory frameworks in place to bridge the digital divide and thus create a more just and equitable digital environment. However, the data suggests that geographic and economic disparities hinder the ability to deliver equitable and inclusive DT. The study suggests that by adopting a layered digital infrastructure and dual approach, utulivu could guide leaders into the development of long-term and gradual approaches that prepare communities for active participation while working towards Utopia.

Uhaki (fairness): Digital leaders should prioritise developing and promoting homegrown digital solutions that align with the needs and aspirations of African communities, rather than replicating foreign models without contextual relevance. Fairness entails recognising and challenging power imbalances in the digital ecosystem to avoid perpetuating dependency and consumerism.

Ujamaa / Letšema: These canons could enable digital leaders to take citizen-led approaches instead of adopting the welfarism approach, which treats communities as passive objects that lack agency (Ye et al., 2021).

Kijitoa (commitment): Dysfunctional, wounded leadership and the colonial mindset contribute to the unconscious and conscious marginalisation and exclusion of rural communities. For example, one respondent highlighted that in some instances, leadership is aware of the problem, or they know the problems, but there is a difference between knowing and acting. In cases where people are aware of the injustices, it is crucial to commit to transformative change. Therefore, Kijitoa suggests that a commitment to long-term strategies supported by monitoring and evaluation, research, and the ability to learn from the past is crucial for transformative digital leadership.

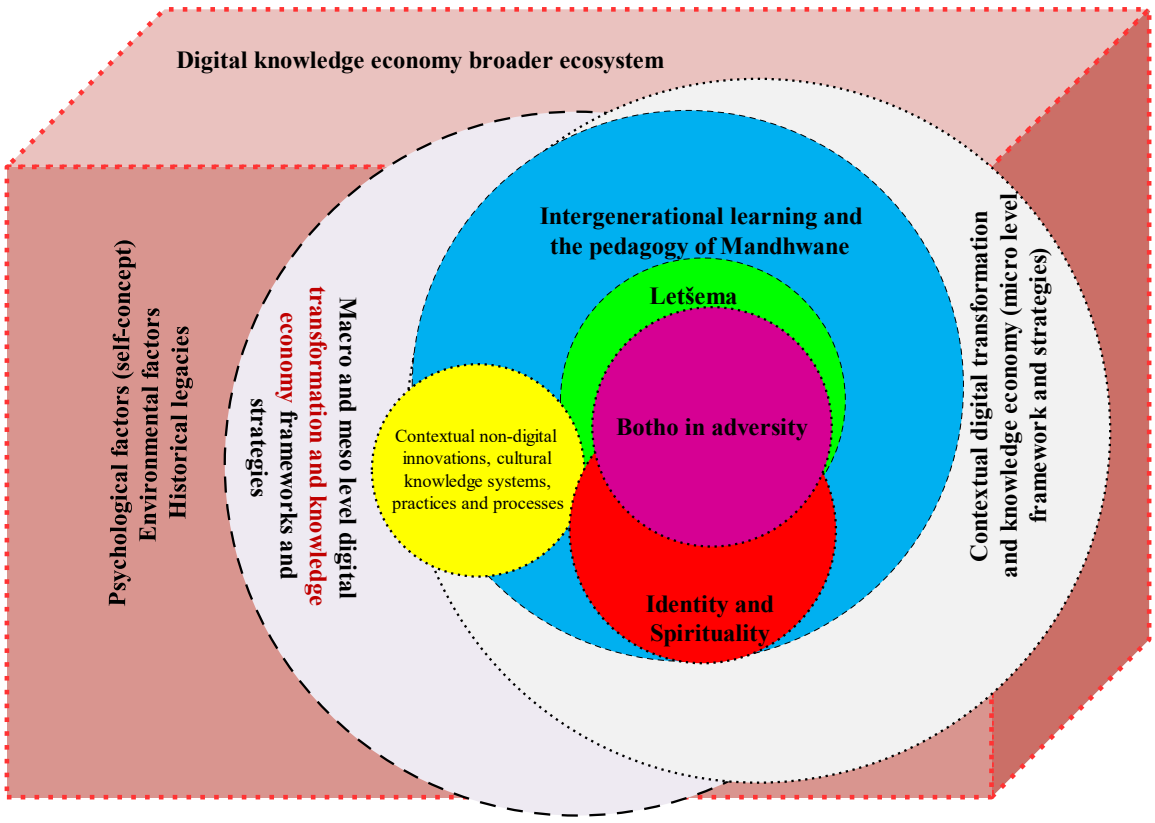
8.7 Synthesis of the discussion and analysis

In addressing the research question, how do cultural knowledge systems facilitate the active participation of African rural communities in DT? The study found that in the context of the MTA, identity, spirituality, Botho in adversity, Letšema collective capabilities, and intergenerational learning form the foundation for fostering inclusive participation in DT and, consequently, the DKE. However, while cultural knowledge systems provide the starting point for participation in DT, overcoming the structural challenges faced by communities in resource-constrained environments requires investments in digital infrastructure and lifelong learning programs. Ethical and values-driven

digital leadership at the macro, meso, and micro levels is also crucial to facilitating a proactive, forward-thinking approach to meaningful and inclusive DT.

In addition to addressing structural barriers, the study found that the passing on of knowledge from Batho ba Bagolo (the elders) to the younger generation also plays a crucial role in guiding ethical digital leadership and ensuring inclusive participation in the digital economy. This finding calls for a rethinking of the role of the older generation in the DKE in an African context. It also challenges the concept of "knowledge" in the digital economy, much like how scholars critically examine the notion of "development" in ICT4D. The need for critique arises because authentic knowledge (tsebo ya nnete) is not separate from the people; if separated, it may imply that participation in the DKE will not authentically reflect the identity of communities in resource-constrained environments. To further elaborate on these conclusions, Figure 8.10 synthesises the interconnectedness of the macro, meso, and micro levels within the DT and, consequently, the DKE ecosystem. It also highlights the complexity of how DT unfolds in resource-constrained environments, such as the MTA, showing how psychological and environmental factors, like migration, rooted in historical legacies shape people's experiences with DT and influence their engagement in the DKE, as discussed earlier.

Figure 8-10: Contextual CKSPPs and their intersection with DT and the KE



Note: This figure illustrates the contextual CKSPPs applicable in this study informed by the findings from the MTA.
Source: Author, 2024

Given these complexities, this study argues that while the attributes of Botho contribute to contextual innovation, relying solely on them risks reducing African philosophy to a set of universal values, thus neglecting the broader interconnectedness of entities within the African thought system. In other words, such a narrow approach could overlook key aspects of African philosophy, including multiple realities, duality, pluralism, relationality, and co-existence. Moreover, isolating these core principles could lead to the conscious or unconscious exclusion of African rural communities in the digital era. Therefore, this study advocates for a shift toward holistic approaches that consider all aspects of the ecosystem, including contextual and communal ways of being, knowing, and doing, and their interplay with environmental and psychological factors.

To summarise the MTA's DT journey, the artwork illustrated in Figure 8.11 depicts the complexities and interconnectedness of the micro, meso, and macro-level systems. It highlights the complexity within which the DT unfolds in resource-constrained environments such as the MTA, presenting both challenges and opportunities.

Figure 8-11: An ecosystem of contextual DT in resource-constrained environments



Note: This artwork [21] depicts the complexity within the MTA and its intersection with the meso and macro level, which DT, illustrating the aspirations, opportunities, and challenges associated with DT. Artist, Matsobane Sox

[21] I commissioned this artwork in 2022 to visualise the narrative emerging from the data analysis. The artist is Artwork by Matsobane Sox (Thabane Matsobane). Matsobane Sox was born and bred in Mamaila village.

In conclusion, this study critiques deterministic ICT4D approaches and their limited engagement with context-specific African ontologies and epistemologies. Building on this critique, the study proposes a shift toward the Digital Mandhwane theory (DM-T), which offers a holistic and culturally embedded approach to foster a contextual, transformative, and innovative state of being within the digital knowledge and learning economy, advancing beyond the ICT4D theory. In the next chapter, I discuss the research claims of DM-T and its philosophical foundations, as well as originality, the significance of this study, its implications, and recommendations for policy, research, and practice.

CHAPTER 9 ：THE DIGITAL MANDHWANE THEORY: AN EMIC CONTRIBUTION TO SCHOLARLY DISCOURSES IN CONTEXTUAL DT

9.1 Introduction

In this concluding chapter, I introduce the Digital Mandhwane theory (DM-T), grounded in the entity of Batho, to address the knowledge gaps identified in the literature. I present the practical applications of the theory through the conceptual Digital Mandhwane Imagined village (DDIV) and the Digital Mandhwane methodological approach (DMMA), illustrating a non-prescriptive, non-deterministic, and contextual transition from a non-digital knowledge economy to a digital knowledge and learning economy. I conclude the chapter with a discussion on scholarly contributions, significance, originality, implications for policy, practice, and research, as well as limitations and future narratives.

While ICT4D has made positive transformative contributions to society, its theoretical frameworks and Eurocentric approaches have faced criticism. Scholars suggest addressing these shortcomings with holistic theories rooted in contextual ontologies and epistemologies. In response to these critiques, I conducted this study to move beyond the technological determinism and generic indigenisation theories often associated with information systems, particularly in the sub-discipline of ICT4D. I aimed to generate an African-inspired theory that advances context-specific ontologies and epistemologies in DT in resource-constrained environments. As a social constructivist and Afrocentric researcher working from an emic positionality, I engaged with the elders and youth from the MTA to co-create and construct the reality of DT based on their lived experiences. I adopted the Mandhwane approach (learning by doing), which embodies the dynamic and continuous process of doing, learning, and reflecting. Furthermore, I employed a multilevel analysis to explore the research question: How do cultural knowledge systems facilitate the inclusive and active participation of African rural communities in DT?

The preceding chapters suggest that DT occurs in a complex and dynamic ecosystem. In addition, the analysis suggests that psychological (self-concept) and environmental factors (migration) emanating from historical legacies shape the experiences of people in DT and, consequently, the DKE. Building on these perspectives, my thesis statement discussed below advances a holistic systems thinking and culturally embedded approach rooted in the NTU communal ways of being, knowing, doing, and leading and their intersections with the environmental and psychological factors in the DT ecosystem.

9.2 Thesis statement: Digital Mandhwane Theory (DM-T)

This thesis proposes a paradigm shift from the deterministic and reductionist approaches often embedded in ICT4D to the DM-T, grounded in the entity of Batho, illustrated in Figure 9.1. This thesis critiques ICT4D for its inadequacy in addressing the interconnectedness of entities within the African thought system and their significance in the DT ecosystem. Furthermore, the thesis argues that although Botho philosophy contributes to contextualisation in ICT4D

and related disciplines, African philosophy is multifaceted and diverse. This critique claims that the absence of holistic approaches that consider contextual CKSPPs, results in:

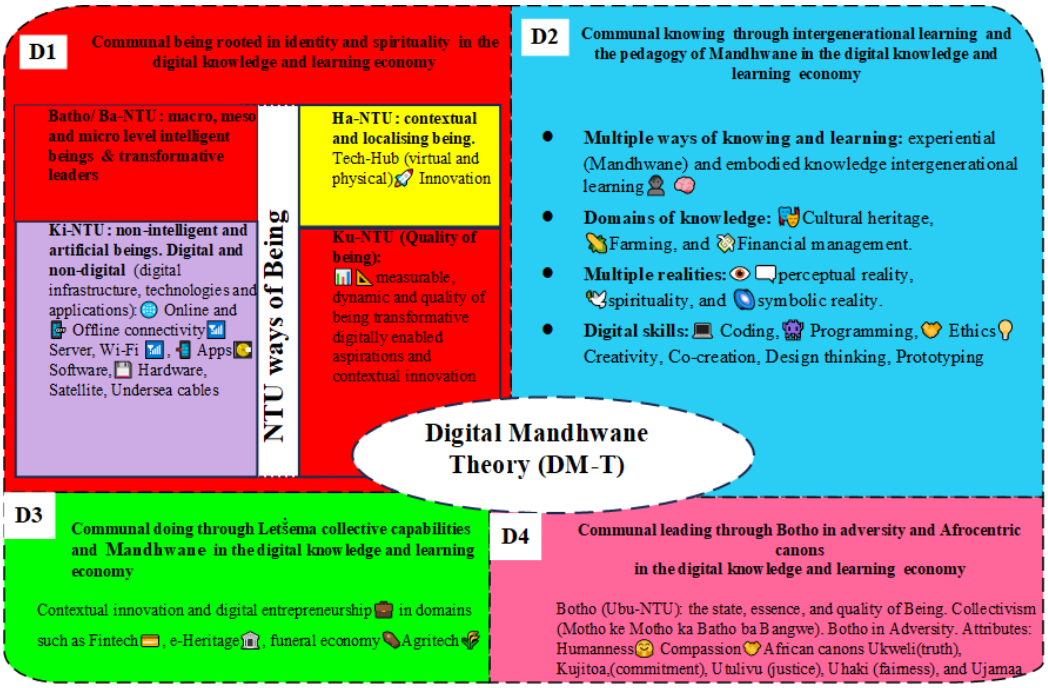
a. Provision of inappropriate digital infrastructure that may not adequately or fully support the development of localised and contextual digital services and applications.

b. Inadequate facilitation of digital skills necessary for contextual, active, and inclusive participation in the digital economy by communities in resource-constrained environments.

c. Introduction of digital solutions that may not be fully relevant to the context and ways of being of resource-constrained communities, with little focus on unlocking collective human capabilities for digital co-creation, often led by digital leaders who impose their views of what they perceive to be important for communities.

Therefore, there is a need to move beyond the limited application of the philosophy of Botho to examine the interconnectedness of the NTU ways of being, knowing, doing, and leading and their interplay with environmental and psychological factors. In understanding how these elements shape the experience of Batho in DT, this thesis proposes a non-prescriptive and non-deterministic contextual approach to DT, contributing to scholarly discourses by theorising the meaning of a transformative state of digital being, through human agency, in the context of the evolving digital knowledge and learning economy, advancing beyond ICT4D theory and technology dependency. The DM-T has four dimensions and many concepts, which are set out in Figure 9.1.

Figure 9-1: The Digital Mandhwane theory: Grounded in the entity of Batho



Note: This figure illustrates the four dimensions of the Digital Mandhwane theory, grounded in the entity of Batho. Source: Author, 2024

Wacker (1998) explains that a theory is a systematic framework that encompasses clear and precise definitions of terms or variables, a specified domain of application, logical relationships between variables, and specific predictions or factual claims derived from these relationships. Noting that qualitative ideas cannot be "precise", we can nevertheless apply the thinking in the Wacker perspective. The DM-T is holistic systems thinking and a culturally embedded framework for understanding and facilitating DT in rural communities in Africa. In accordance with the perspective offered by Wacker, the domain of application for the DM-T is DT within the context of African philosophy. Grounded in the entity of Batho and drawing on African philosophy, the DM-T aims to provide an African-inspired framework for understanding communal existence, learning, doing, and leadership in the DKE. The theory emphasises the interconnectedness of entities within the DT ecosystem. It incorporates four dimensions:

Dimension 1: Communal being rooted in identity and spirituality: This dimension forms the foundational underpinning for the essence of communal existence, emphasising the inseparability and dynamic interactions of the NTU ways of beings. In the DM-T, the interconnectedness between human beings (Batho/ Ba-NTU), their temporal space and time (Ha-NTU), digital and non-digital resources (Ki-NTUs), and their quality of being (Ku-NTU) serve as the foundation for inclusive and active participation in the non-digital and digital economy.

Dimension 2: Communal knowing through contextual intergenerational learning and the pedagogy of Mandhwane: This dimension focuses on the importance of community-based learning approaches and the acquisition of contextual digital skills, emphasising experiential learning (Mandhwane) and intergenerational learning.

Dimension 3: Communal doing through Letšema and Mandhwane: This dimension focuses on communal collective action. The dimension explores opportunities for communal DT rooted in communal identity and spirituality and actioned through Mandhwane learning by doing.

Dimension 4: Communal leading through Botho in adversity and Afrocentric canons: This dimension explores the role of Botho in adversity as a contextual axiology that unlocks Letšema collective capabilities. Furthermore, the dimension incorporates Afrocentric canons as strategies to navigate the complexities in the DT ecosystem.

Collectively, the four dimensions of the DM-T provide a comprehensive framework for understanding communal existence, learning, action, and leadership in the DKE. Rejecting ICT4D reductionism and adopting holistic systems thinking and a culturally embedded approach offers a nuanced understanding of the complex interconnections of the entities within the DT ecosystem. From a philosophical standpoint, the NTU ways of being offer a structured and holistic systems thinking framework for exploring the interconnectedness of both human and non-human entities in DT. The DM-T suggests that the separation of any NTU ways of being from each other establishes a foundation for an exclusive kind of DT. Consequently, this separation extends to the DKE. The key concepts below provide insights into the interconnectedness of human and non-human entities, their application in the DM-T and their relevance in DT.

a. **Mu-NTU (Mo-Tho)/ Ba-NTU:** within the DM-T Ba-NTU (Batho) refers to the macro, meso and micro level actors who are the intelligent beings, who possess the agency to engage in transformative or

exploitative DT.

b. **Ha-NTU:** is the physical and virtual localising and temporal being intersecting the global spaces and communal processes. In this hybrid space, Batho can acquire digital skills and actively apply their knowledge to create both digital and non-digital Ki-NTUs (products and services).

c. **Ki-NTUs:** refers to digital and non-digital entities that lack human intelligence but may possess artificial intelligence. These Ki-NTUs require the agency of Motho and Batho to unlock their transformative potential within the DM-T, Ki-NTUs include infrastructure, digital products, and services.

d. **Ku-NTU:** is the dynamic state and quality of being innovative and transformative in the digital knowledge and learning economy. Within the DM-T the dynamic state and quality of being is the outcome of the non-prescriptive and non- deterministic processes.

e. **Identity and spirituality:** identity in the DM-T is shaped by ancestry, kinship, family/clan structures, and communal belonging, while spirituality encompasses beliefs in cosmic forces and their influence on daily life.

f. **Mandhwane and intergenerational learning:** in the DM-T, Mandhwane is a Mind mobilisation, socialisation and transformative approach that aims to empower Batho to reimagine their future in the digital era. The learning approach integrates the principles of andragogy and heutagogy (Self-directed and adult learning principles) to foster a culture of intergenerational learning.

g. Letšema collective capabilities: in the DM-T, Letšema embodies the concept of "people as infrastructure" as articulated by (Simone, 2021), emphasising the interconnectedness of entities, and the voluntary participation of individuals in shaping collective aspirations, capabilities, adaptability, and innovation within their communities.

h. Contextual innovation: this study conceptualises innovation as a multifaceted process, encompassing both digital and non-digital practices, intricately shaped by ontology and epistemology in local and contextual frameworks (Kochetkov, 2023; Kumar & Saizen, 2023; Maarsingh et al., 2023)

i. Botho in adversity: refers to the cultural value and practice of solidarity, collective support, and resilience during challenging times. Within the DM-T the Botho in adversity represents the collective response of communities to social and digital challenges.

j. Afrocentric canons: in this study, Afrocentric canons adapted from Reviere (2001) discussed in section 8.6.2 refer to ethical and people-centred leadership that promotes inclusivity, and community-centric approaches.

In the following section, I unpack each dimension of the DM-T to illustrate the applicability of its non-prescriptive and non-deterministic approach, emphasising the centrality of African philosophy in DT, specifically the principles of multiple realities, duality, relationality, and co-existence.

9.3 Unpacking the DM-T dimensions

This next section unpacks the detailed thinking about how the four dimensions of DM-T are constituted, providing an understanding that the theory is based on deep analytical thinking, beyond the superficiality often associated with theoretical work.

9.3.1 Communal being rooted in identity and spirituality

This study argues that although ICT4D scholars within African contexts, particularly in South Africa, rely on the philosophy of Botho as one of the theories for indigenisation and contextualisation, there is insufficient consideration given to the interconnectedness among entities within African philosophy, which are foundational to the essence of existence (Botho), and DT. This lack of consideration overlooks the multiple realities inherent within African philosophical thought, where identity, spirituality, and daily activities are deeply intertwined, shaping Bathos' interactions with digital technologies, usage, and uptake. Moreover, skills, infrastructure, and methods of acquiring and applying knowledge are often treated as distinct entities, disconnected from batho's identity, spirituality, and day-to-day ways of knowing, doing, and leading. In contrast, the DM-T emphasises the interconnectedness of Batho with other non-human entities, their identity, and spirituality, as the foundation for facilitating inclusive and active participation in DT and, consequently, in the DKE. According to the DM-T, the fundamental principle of African philosophy is that nothing exists for its own sake, highlighting the interconnectedness and relationality of entities. Therefore, the DM-T emphasises that entities within the DT cannot be operationalised and examined in isolation. The DM-T suggests that when relationality in DT is limited to humans and digital technologies, it introduces a disconnect from other non-human entities that are equally important in creating favourable conditions to unlock the transformative potential of digitalisation processes.

a Batho: The intelligent beings

In contrast to conventional DT theories that perceive Batho as passive beneficiaries and consumers of pre-packaged digital services and solutions, the DM-T suggests that Batho possess the intelligence and capabilities to self-determine. As intelligent beings, Batho have the agency to participate in transformative or exploitative DT. Thus, they can rely on their collective intelligence and capabilities to co-create digital products and services and engage with other actors in the ecosystem to deploy digital infrastructure when the environment is enabled. Leveraging their familial, clan systems, and community structures rooted in Botho in adversity, Batho have the potential to establish Letšema digital networks integrating with existing non-digital networks.

b Ha-NTU: The localising being

Within the DM-T, Ha-NTU is the hybrid localising being and temporal space for contextual DT where Batho could apply their collective intelligence and capabilities to unlock the transformative potential of digital Ki-NTUS. The localising space intersects with the being dimension, emphasising the significance of local context and CKSPPs, and their role in creating a foundation for contextual DT. Unlike conventional digital transformation theories that separate entities from their temporal spaces, in the DM-T, space and time are inseparable from Batho, and their NTU ways of being, knowing, doing, and leading. Therefore, instead of providing one-dimensional interventions that view learning spaces as separate entities from the other beings, the DM-T suggests that existing temporal spaces could play a pivotal role in embedding new ways of doing things. As a result, there is a critical need to rethink physical and institutionalised spaces branded as exclusive locations and primary focal points for digital transformation. Moreover, while the universal approaches to digital transformation advocate leapfrogging and integration into the global digital knowledge economies, the DM-T suggests that Ha-NTU is more than just a physical space where people consume digital services. It is a foundational and affirming space where the integration of digital technologies should come before global integration. The proverb "Gae ga mahlaku, moo khutšo, lerato le tlhompho di itshamilego ntshe ka mathokong ohle" (home is a place of abundance, love, respect in all aspects of life including the DKE) encapsulates the importance of grounding innovation in temporal spaces. The proverb implies that Ha-NTU as a localising being provides the preparedness to engage with externally focused digital processes. Therefore, while learning from external contexts, Ha-NTU could nurture the development of skills and innovation by emphasising contextual relevance to avoid a perpetual cycle of consumerism and catch-up strategies. The Igbo proverb "Nku di na mba naeghere mba nri" grounds the actions of Batho within the DM-T. The proverb encapsulates the essence of contextual innovation and reinforces that innovation and DT are deeply rooted in the specific environment in which they occur. In cases where Batho are learning from others, it is crucial to adapt the learning to suit the context and alignment with Ha-NTU aspirations. Thus, Batho must first seek to understand and appreciate their unique context before seeking global integration.

The DM-T further suggests that instead of making assumptions about the availability of Batho to engage in digitalisation processes, it is crucial to assess the family and community structures by asking the following questions.

- who truly resides at Ha-NTU? (who is at home?) and what is the impact of migration in the community?
- what are their digital aspirations and existing capabilities?
- what are their lived realities and experiences versus the external perceptions of Ha-NTU?
- how do social hierarchies and power dynamics within Ha-NTU influence access to and control over digital resources?
- how do digital aspirations and capabilities vary across different age groups within families in Ha-NTU?

Thus, in contrast to the conventional technology deterministic approaches, the DM-T critically assesses existing digital capabilities, aspirations, and fears, and hopes to assess how these factors could enable or constrain contextual DT.

c Ki-NTUs: Transformative tools

In African philosophy, Ki-NTUs are non-intelligent entities that require Batho to act on them to realise perceived and potential benefits. Within the DM-T, Ki-NTUs include tools such as infrastructure, digital technologies, and applications. These tools depend on the agency of Batho to realise their transformative potential. Therefore, a Ki-NTU like Wi-Fi can just exist until Motho takes action to unlock its transformative power, rendering the inanimate objects or being inert without Motho's intervention. In contrast to externally deployed Ki-NTUs, the theory advocates for the implementation of localised digital solutions designed to facilitate community interactions and address multiple purposes beyond Internet-centric approaches. Furthermore, while the theory is non-prescriptive, it acknowledges that in the DT and KE, digital Ki-NTUs are central because of their transformative power. However, in the DM-T, technology as a non-intelligent being or inanimate object does not take precedence over other beings. Therefore, for technology to find its full expression, it needs to co-exist with the other beings. Drawing inspiration from Mavhunga's (2014) concept of "nzira", the DM-T asserts that digital Ki-NTUs must be dynamic and possess multifaceted qualities to provide Batho with diverse ways of accomplishing tasks, reliant on the collective contributions of others as opposed to the individual-centric solutions.

d KU-NTU: Measurable, quality and state of being in the DKE

The DM-T suggests that communities in resource-constrained environments have the potential to experience meaningful and self-defined DT if the environment is enabled. Therefore, the exclusion in DT is not the result of a lack of innovative mindsets or aspirations, but because of institutionalised barriers and exclusions. The theory therefore suggests that Batho have the agency to define their aspirations and use the available digital resources to transform their lives without adhering to external pre-defined or determined outcomes. However, the transformative potential depends on the ongoing creation of conditions and environments that nurture innovative mindsets and life-long learning supported by appropriate digital infrastructure. Moreover, active participation requires committing to long-term strategies where being and becoming innovative and transformative are integral parts of socialisation. Therefore, the DM-T posits that, through active and inclusive participation, Batho have the potential to lead themselves into a measurable, transformative, and innovative dynamic state and quality of being in the digital knowledge and learning economy.

9.3.2 Communal knowing through Mandhwane and intergenerational learning

Mandhwane is a cultural practice in Southern Africa, serving as a reflective and futuristic learning approach that prepares children for their role in society to ensure that they become fully functional and capable beings. As discussed in the literature, Mandhwane has undergone a transformative journey, adapting to changing cultural dynamics while still retaining its core principles of practical learning. Despite its evolution, children in various communities continue

to play Mandhwane although not in its original format. In its original form, it equipped children with the skills and knowledge to fulfil the societal needs of pre-colonisation. In the DM-T, communal knowing through Mandhwane aims to respond to the digital aspirations of today while taking a futuristic approach. In contrast to the analogue Mandhwane, communal knowing and learning is facilitated through virtual and physical spaces. The communal hybrid ecosystem nurtures a culture of innovation and knowledge production in the 21st century. Unlike the conventional digital skills programme that often decontextualises digital skills, in the DM-T, knowledge and skills acquisition are not separate from the being, doings and leading. Mandhwane pedagogy acknowledges the importance of multiple domains of knowledge, including cultural heritage, farming, and financial management. The theory suggests that integrating digital skills into contextual innovations through experiential intergenerational learning could unlock digital innovations and lifelong learning, while preserving cultural heritage.

The DM-T recognises that knowledge is not limited to one reality but encompasses multiple perspectives, including perceptual reality, spirituality, and symbolic reality. For instance, within the DM-T the spiritual, perceptual and symbolic realities converge as exemplified by the emergence of tech funeral and the cultural heritage preservation in MTA. The proverb "Rutang bana ditaola, le se ye le tšona badimong" (the intentional transfer of wisdom, knowledge, and skills to the younger generation) provides an Afrocentric and futuristic foundation for nurturing the development of 21st-century digital skills targeted at Generation Z and Alpha. The theory suggests that concentrating on children could offer macro-level actors tangible proof of the nature of the revolution and transition to non-prescriptive, contextual DT. The participation of Generation Z and Alpha in communities in resource-constrained environments in the DT ecosystem could serve as a tangible measurement of the nature and quality of the revolution. Additionally, the DM-T advocates for principles such as collaboration, experimentation, continuous learning, and reflection. These principles serve as catalysts for communal knowing, promoting the dynamic application of knowledge and skills to drive purposeful actions.

- **Collaborating and co-creating:** This principle entails active participation in the co-creation of digital solutions aligned with the contextual aspirations of Batho across domains such as communal farming, cultural heritage, and financial services. The principle recognises that collective human agency and self-determination, rooted in identity and spirituality, are essential catalysts for unlocking contextual digital learning and the development of digital skills.
- **Experimenting and prototyping:** This principle entails embracing a continuous learning process through practical experimentation and prototyping. It serves to reinforce the translation of the acquired knowledge and the abilities of Batho to unlock the transformative potential of the digital Ki-NTUs. Additionally, the principle acknowledges that while robust digital infrastructure is vital for the DKE, frugal and cost-effective solutions enable the application of the acquired knowledge, contributing to the gradual approach to skills development. Moreover, the hands-on experimentation enables different generations to actively engage with digital tools, co-create while facilitating intergenerational learning rooted in cultural heritage narratives.

- **Learning from errors:** This principle is operationalised through iterative and self-reflective processes, where feedback and continuous reflection actively contribute to refining the learning actions. As exemplified by the case of Leola funeral scheme, through ongoing reflection and feedback, community members not only refine their own learning actions but also share their experiences and insights with others, fostering a culture of continuous improvement and mutual support.

9.3.3 Communal doing through Letšema and Mandhwane

In the DM-T, communal doing through Letšema and Mandhwane represents the convergence of being, knowing, and leading. As discussed in the literature review, Letšema is a cultural practice in many African communities, specifically in Southern Africa. Despite undergoing cultural changes in response to societal shifts, Letšema continues to play a significant role in modern society. In the context of this study, Letšema is used to organise and implement community innovations like the Leola funeral scheme, burial societies, and financial and non-financial stokvels. Thus, the DM-T considers Letšema as one of the cultural ways in which communities in resource-constrained environments demonstrate their agency and self-determination by mobilising their collective intelligence and capabilities to find solutions to address various adverse conditions. Therefore, the DM-T contends that micro-level actors have the agency and self-determination to actively lead their DT agenda when the environment provides necessary inputs like infrastructure, knowledge, and skills. The DM-T advocates for implementing contextual innovation that supports and benefits the collective by first leveraging the strengths of individuals and communities, utilising existing practices and processes.

The collective doings or the actions in digital transformation provide an opportunity to assess how Botho expand/enables positive social and economic change. Botho in adversity is a contextual axiology that serves as an ethical framework for implementing non-digital innovations, laying the foundation for facilitating DT, unlocking local economic value chains, and the Letšema big data analytics. In the DM-T, communal action through Letšema and Mandhwane advocates for integrating contextual values such as Botho in adversity into the socio-economic and technological aspects of the community. The convergence of the Letšema being knowing, and leading focuses on the application of knowledge to produce tangible actions across various domains within Ha-NTU by leveraging digital technologies to unlock local and communal value chains and the potential for contextual Letšema big data analytics.

Letšema actions within the DM-T are rooted in the African principle of duality, where collective actions are capable of producing multiple outputs and outcomes as exemplified by the Leola funeral scheme. Therefore, the DM-T advocates the implementation of contextual innovation that demonstrates the transformative potential of digital technologies at a communal level through Letšema, while enabling individual aspirations. Moreover, the practice is rooted in the proverb, “pšhiša madibana e pšhiša a magolo (small actions lead to big actions in the future).” The proverb implies that while big bang strategies are often necessary for DT, small actions are part of the gradual and progressive approach towards people-centred and transformative DT.

9.3.4 Communal leading through Botho in adversity and Afrocentric canons

The DM-T views the exclusion of communities in resources constrained in the digital economy as a form of adversity that requires Batho to unlock their collective action and self-determination in the DT. The philosophy of Botho, in the DM-T, serves as a foundational ethical framework that underpins the mobilisation of communities to harness their existing capabilities within contextualisation processes. For example, in the MTA, Letšema effectively translates the values of Botho into actionable steps through experiential learning.

The theory advocates for communal leadership, emphasising the need for collective action to overcome adversities such as exclusion, digital colonisation, and adverse digital incorporation. Grounded in African philosophy and implemented through the Afrocentric paradigm, the theory highlights the importance of transformative digital leadership, characterised by embracing diversity and recognising the agency of individuals in shaping their DT paths. To navigate the complexities of DT, the DM-T advocates for leaders at all levels to embrace Afrocentric principles such as ukweli (truth), kujitoa (commitment), utulivu (justice), uhaki (fairness), and ujamaa, serving as an ethical framework for guiding Batho's actions at all levels.

At the micro-level, the theory encourages active participation in DT discourses guided by the proverb Hlapi holofela leraga meetse a pšhile o a bona ("fish trust in the mud, water dried out while you were looking, the proverb means that when children are used to being provided for by their parents they become spoilt and when their parents die or become old, they are left in destitute when they have to work and provide for themselves" (Kgarose, 2020). The theory advocates for micro-level collective consciousness regarding the digital divide and adverse digital incorporation, supported by the proverb Tau tša hloka seboka di šitwa ke nare e hlotša (lions that fail to work as a team, struggle to bring down even a wounded buffalo) instead of waiting for macro and meso level actors who often provide decontextualised solutions that promote welfarism and consumerism.

9.4 The philosophy of the Digital Mandhwane theory

The philosophy of the DM-T is that understanding the nature of existence, how knowledge is acquired and applied, and the values that guide actions are crucial aspects that cannot be separated from the entities and processes involved. Thus, entities in the DT ecosystem are inseparable from ontology, epistemology, and axiology. Consequently, to fully understand the complexities of DT and devise transformative policies, regulations, and implementation strategies the entities cannot be examined in isolation. The next section offers a detailed discussion of the philosophy of the DM-T.

9.4.1 Ontological stance: "Nothing exists in isolation"

Ontologically, the DM-T is grounded in the holistic nature of African thought, emphasising interconnectedness. Within the DM-T framework, ways of living are rooted in systems thinking. As a result, the separation of any entities in DT leads to exclusivity and potential vulnerabilities within the ecosystem. According to the DM-T philosophy, NTU ways of being, knowing, doing, and leading in an African context are diverse and embody principles of

pluralism. Pluralism implies that entities cannot fully find expression and meaning without co-existence. For example, digital must coexist with non-digital, offline with online, and both must possess contextual relevance. Thus, in the DM-T, technology is not just a tool but a reflection of the African thought system, incorporating the principles of pluralism and duality.

9.4.2 Epistemology: Knowledge does not exist for its own sake

Epistemologically, the DM-T is rooted in the following proverbs:

a. Rutang bana ditaola le se ye le tšona badimong (the intentional transfer of wisdom, knowledge, and skills to the younger generation): Batswadi rutang bana ba lena mekgwa ye mebotse le mabohlale ohle a lefase le a tsebago gore mohla le hwago bana ba lena ba šale ba phela go se matshwenyego. (Parents teach your children all the good manners and wisdom the world knows so that when you die your children will live without worries).

b. Tlogatloga e tloga kgale, modiši wa kgomo o tšwa natšo (those who possess capabilities and excellence do so because of their early commitment and investments). Therefore, what people see are the outcomes of their commitment and hard work: Mang le mang- a o swanetše go ithuta mediro e sa le yo mofsa gore mohla a godile a tle a kgone go e šoma gabotse go fetiša ga a ka ithuta yona mola a godile, gobane a ka se tsebe ka tshwanelo (It is wise to learn new skills while still young and to invest in developing skills at a young age in preparation for the future to avoid catching up at an older age).

c. Mmala wa kgomo o gola namaneng: Go loka le go itapiša ga motswadi go bonala godimo ga ngwana wa gagwe, gobane ka yena go bonala seo motswadi a lego sona, ka mekgwa le ka bohlale. (“the colour of a cow grows on the calf’ are about the general beliefs that children learn their behaviour from their parents and that parents do things for the benefit of their children with the hope that they will help or care for them in future. Therefore, it is an unexpected event when children turn against their children or fail to live according to their parents’ teachings” (Kgarose, 2020).

Collectively, the proverbs highlight values such as intergenerational knowledge transfer, preparedness, experiential learning, progression, communal interactions, and forward-thinking approaches to learning and digital skills development, values that are often not present in the more consumerist-oriented government-led or donor-led ICT4D initiatives. Furthermore, the proverbs imply that authentic knowledge transfer is integral to Ha-NTU, directly linked to the aspirations of Batho. Inspired by the proverb “Tlogatloga e tloga kgale, modiši wa kgomo o tswa natšo” (those who possess capabilities and excellence do so because of their early commitment and investments), the theory advocates a balanced approach, the need to invest in long-term and gradual strategies for lifelong learning.

The proverb “Mmala wa kgomo o gola namaneng” (“the colour of a cow grows on the calf), implies that the efforts at the macro-level towards building digital skills capabilities will reflect at the micro-level. The proverb underscores

the need for intentional efforts to change the narrative of communities and children in resource-constrained environments. Thus, one cannot expect different outcomes without laying the foundation for the desired change. Consequently, micro-level experiences (transformative or exploitative) are the product of their macro- and meso-level environments. Everyday ways of being and doing provide tangible measurements of the effectiveness of the acquired knowledge and how people apply and integrate it into daily processes. Therefore, a true measurement of the macro level policies and strategies is not reflected by how well they are written, or the global rankings, but by the lived experience of the people. The proverb "Rutang bana ditaola, le se ye le tšona badimong" (the intentional transfer of wisdom, knowledge, and skills to the younger generation), encapsulates the futuristic approach embedded in African knowledge transfer. The proverb highlights the importance of imparting cultural wisdom to the next generation, ensuring the preservation of heritage and knowledge as the foundation for innovation and DT.

9.4.3 Axiology: Tau tša hloka seboka di šitwa ke nare e hlotša (lions that fail to work as a team, struggle to bring down even a wounded buffalo)

The axiology of DM-T, in other words, the values of the digital leadership that drives DM-T, is rooted in Afrocentric canons (see section 8.7.3) and the philosophy of Botho, guiding the actions and decisions of Batho in the DT ecosystem. Furthermore, the principle of kujichagulia (self-determination) and community agency frames the design and implementation of DT initiatives. The proverb "Tau tša hloka seboka di šitwa ke nare e hlotša" (lions that fail to work as a team, struggle to bring down even a wounded buffalo) as explained by Kgarose (2020) underscores the critical importance of unity and collaboration. In the context of DT, this proverb calls for collective consciousness and ethical leadership across multiple levels. The values of digital leadership relate to the commitment to justice, fairness, truth, humanness, compassion, inclusivity, co-creation, and self-determination.
In the following section, I discuss the practical applications of the DM-T through the conceptual DDIV to illustrate a non-prescriptive, non-deterministic and contextual transition from a non-digital knowledge economy to a digital knowledge and learning economy.

9.5 Digital Mandhwane practice: Imagined village

The DDIV exemplifies the transition from theory to practice, showcasing the practical implementation of community-centric DT. The DDIV provides insights into the convergence of being, knowing, doing, and leading, and their interplay with environmental and psychological factors. Moreover, the village illustrates how to transition from a non-digital economy to a non-prescriptive and contextual digital transformation that fosters favourable conditions for a transformative and innovative dynamic state and quality of being in the digital knowledge and learning economy.

The DDIV adopts a community-centric approach, contrasting with externally guided strategies focused on technology adoption with predetermined outcomes. Instead of merely bridging the digital divide, it fosters a transformative transition towards a dynamic state in the digital knowledge and learning economy. This foundation is rooted in cultural identity, expressed through ancestry, spirituality, kinship, Botho in adversity, and Letšema. These cultural

elements shape the non-digital economy and its collective capabilities, providing the basis for a digitally enabled economy. Relationships between families, clans, and neighbourhoods serve as exchange points for Letšema collective work and collaboration, including financial and non-financial transactions, and knowledge sharing. Letšema collective intelligence enables Batho to self-organise, fostering collaboration, shared learning, and contextually relevant innovations. The integration of agri-tech, fintech, e-heritage, and the funeral economy illustrates this shift, with farming and cultural heritage bridging non-digital transactions and digital aspirations.

Challenges such as migration have weakened the community's collective capabilities, leading to a loss of cultural memory. As a result, this cultural erosion hinders technological adoption, especially among the elderly and children, who struggle to navigate modern tools and technologies. Moreover, concerns about modernisation and the erosion of traditional practices exacerbate these challenges. In addition to these technological barriers, psychological factors and historical legacies also come into play, often manifesting as inferiority complexes that further inhibit progress. Furthermore, tensions between individual and collective aspirations, particularly in farming, hinder collaboration and the collective development of resources. In response to these challenges, leaders rely on Afrocentric canons to facilitate a people-centered transformation, aiming to balance tradition with progress. However, digital infrastructure challenges remain a significant concern, particularly focusing on the cost and reliability of internet connectivity. Complaints about limited Wi-Fi, slow speeds, privacy concerns, and rapid data depletion are widespread, further hindering digital engagement. Additionally, digital entrepreneurs face the burden of high hosting costs and slow internet speeds, which restrict their growth potential. Despite these hurdles, the community network, which offers both offline and online capabilities, provides essential connectivity and supports the Letšema learning facility, ensuring that some access to technology remains possible.

The Letšema learning facility, both physical and virtual (see Appendix U), aligns digital solutions with the community's needs. In doing so, this facility enables children to acquire coding and programming skills, providing them with the tools to navigate the digital world. Additionally, it allows others to design and prototype digital solutions within the local network, fostering innovation within the community. Furthermore, localised digital applications, such as knowledge management systems, Leola fintech, agri-tech, e-heritage platforms, e-marketplaces, and farm management software, facilitate transactions and learning processes that contribute to achieving collective aspirations. These applications, in turn, unlock the potential for a Letšema big data analytics framework, helping to aggregate and analyse valuable data for future development. In parallel, offline infrastructure further supports digital entrepreneurship, particularly in sectors like farming, funeral services, financial services, and cultural heritage, where digital tools can enhance productivity and efficiency. Moreover, the integration of the learning facility and the socio-economic value chain, facilitated by digital connectivity, creates conditions for unlocking the digital knowledge economy at Ha-NTU. As a result, Appendix V illustrates the imagined confluence of real-life and potential components of the DDIV, encompassing appropriate infrastructure, access to devices, digital learning facilities, and contextual digital apps that are informed by communal, household, and individual aspirations.

The inseparability of knowing from doing is central to the Imagined village, emphasising that true transformation requires the active application of knowledge in real-world contexts. The learning process is integrated with practical engagement to ensure measurable outcomes. Older generations view the younger members as crucial in bridging the past, present, and future. Generations Z and Alpha play a key role in exchanging digital skills with older generations while acquiring cultural heritage knowledge in return. This reciprocal process positions Generation Z as key players in integrating cultural knowledge with technology, grounded in the entity of Batho. In summary, the village exemplifies a model of community-centric DT, where cultural values are integrated with innovative technologies.

9.6 Digital Mandhwane methodological approach (DMMA)

The DMMA bridges the gap between practice, research, and theory by providing practical insights on designing and conducting contextual DT research. The methodology applies a multilevel approach, focusing on the intersection between the macro-, meso-, and micro-level perspectives. The methodology offers holistic systems thinking and understanding of contextual cultural practices and processes, as well as the acquisition and co-creation of knowledge, and the interplay with environmental and psychological factors. The core and guiding principle for the DMMA is that understanding the cultural framework and holistic exploration of community practices, aspirations, the role of structures, and intergenerational dynamics is the starting point in contextual research (see Appendix W). Unlike conventional approaches that pre-determine Botho as the main cultural foundation in African communities, the DMMA initiates the process with a survey to determine the intersection between cultural knowledge, technology, aspirations, and the economy. In contrast to research methods that focus on the technology user acceptance theory and the technology acceptance model, the DMMA focuses on understanding the AS–IS status to ensure that the activities of the action research are informed by contextual realities instead of pre-defined realities.

Acquiring contextual knowledge through co-creation is a key aspect of the DMMA. Using preliminary findings from the survey, the researcher facilitates intergenerational conversations through focus group discussions, community expert interviews, and mind mobilisation workshops to explore highly valued cultural practices and processes. While the specific outcomes of the action research are not predetermined, the DMMA suggests that facilitating intergenerational conversations regarding the nexus of culture, technology, and the local economy leads to awareness in the community. Consequently, if conversations continue to take place, there is the potential for contextual DT to emerge. In this study, the conversations created awareness of the benefits of preserving cultural heritage and using digital tools, and the potential benefits and disadvantages of digitalising the collectively owned processes. As a result, the community interactions could potentially contribute to an ecosystem that mobilises Batho to unlock contextual digital innovations and assume various forms of leadership, for example, infrastructure, content development, design, skills, farming, and digital entrepreneurship.

9.7 Digital Mandhwane scholarly contributions, significance and originality

Presthus and Munkvold (2016) outline several ways in which knowledge is contributed within IS research. These include offering practical insights such as lessons learned and experience reports, developing theoretical frameworks,

and making contributions to existing theories. This study significantly contributes to knowledge by enhancing scholarly understanding in three key areas, namely, the DM-T, the practical implementation approach through the conceptual DDIV, and the DMMA research methodology. These contributions deepen scholarly knowledge of how contextual ontologies, epistemologies, and axiology influence DT, particularly from the perspective of the Global South.

Firstly, this study significantly contributes to scholarly knowledge by introducing the DM-T, rooted in the entity of Batho, which encompasses NTU ways of being, knowing, doing, and leading, and explores their interplay with environmental and psychological factors. DM-T aims to foster a contextual, transformative, and innovative state of being within the digital knowledge and learning economy, offering a culturally embedded perspective that advances the discourse beyond traditional ICT4D theories. The exploration of the NTU ways of being from an emic standpoint provides insights into how grounding DT in the African philosophical thought system could unlock active and inclusive participation by communities in resource-constrained environments. The inseparability of the NTU ways of being from the NTU ways of knowing, doing, and leading, and the interplay with environmental and psychological factors expand the scholarly discourses on the complexity of the DT ecosystem in an African context and the critical need for systems thinking. Integrating the Afrocentric lens in Hanna's digital transformation framework contributes to interdisciplinary discourses. The Afrocentric canons adapted from Reviere (2001) offer practical insights to expand scholarly understanding of the role of axiology in fostering people-centred DT.

Secondly, the study contributes methodologically through the DMMA, which operationalises the DM-T framework by offering tools and techniques for implementing participatory action research. While the DM-T provides the theoretical foundation, the DMMA methodology applies this framework in practice, making an integrated contribution to both theory and methodology in ICT4D. Moreover, adapting Khumbane's philosophy of Mandhwane and mind mobilisation principles to DT expands the understanding of community-centric approaches. The adaptation contributes to interdisciplinary research in digital transformation, offering empirical evidence on how strategies and methodological approaches from diverse fields can be applied to address technology determinism embedded in ICT4D.

Thirdly, at the practical level, the multidimensional approach presented by the conceptual DDIV offers practical insights on transitioning from a non-digital to a digital knowledge and learning economy rooted in a contextual cultural framework. Moreover, the context-specific approach expands scholarly discourse by introducing Botho in adversity as a communal axiology. Botho in adversity is a contextual axiology that serves as an ethical framework for implementing non-digital innovations, laying the foundation for facilitating DT, unlocking local digital innovations, economic value chains, and Letšema data analytics.

Lastly, this study is significant and timely because it is in alignment with the forthcoming Journal of Information Technology for Development focusing on "Alternative local[ised] philosophies for sustainability transformation in

ICT4D[22]," which seeks to explore how non-Western philosophies shape information systems in communities, thereby enriching our understanding of holistic, bottom-up transformations that move away from (post)colonial influences and emphasise local ontologies, epistemologies, and practices (Kreps et al., 2024). This forthcoming publication underscores the growing recognition among scholars of the need to explore alternative and localised philosophies in ICT4D

Baptista et al. (2015) argue that originality in doctoral studies encompasses not only the research outcome but also the entire process leading to that outcome. According to Golding et al., (2014, p. 571)

> "an original contribution [to research] might be opening up a new area of research or reframing an old issue; it could involve introducing a new method, theoretical frame or concept, or applying established methods, theories and concepts in new areas; a thesis can make an original contribution by gathering new data which lead to new findings and conclusions, or by providing a novel interpretation or synthesis of established data, theories or conclusions."

This study claims originality by deriving the philosophical foundation of the DM-T from the African thought system of holism, specifically beyond Botho philosophy. The originality of the DM-T lies in its exploration of the interplay between NTU ways of being, communal ways of knowing, doing, and leading, as well as environmental and psychological factors.

The methodological approach contributes to originality by grounding the design of action research in the pedagogy of Mandhwane embedded within a contextual cultural framework. This includes acknowledging the role of communal intergenerational collaboration in co-creating contextual digital solutions. Finally, the study claims originality in the operationalisation of the DM-T through the design of the conceptual DDIV, supported by the artefacts produced as part of this study. The conceptual Imagined village offers original insights into how communities in resource-constrained environments can transition from a non-digital knowledge economy to a digital knowledge and learning economy.

9.8 Implications for policy, practice, and research

Macro-level actors: In line with the axiology of the DM-T, the proverbs "Hlapi holofela leraga" and "Tau tša hloka seboka di šitwa ke nare e hlotša" are suggested as reflective tools for macro-level actors to guide their actions in facilitating people-centred DT. The study suggests considering a paradigm shift from an infrastructure and Internet-centric approach to a dual and Batho-centric one. This dual approach encourages exploring hybrid infrastructure deployment that acknowledges the multiple realities and lived experiences of communities in resource-constrained environments, including internal social interactions and contextual digital solutions that may not always require Internet connectivity.

[22] Alternative Local[ised] Philosophies for Sustainability Transformation in ICT4D.
https://think.taylorandfrancis.com/special_issues/alternative-localised-philosophies-sustainability-transformation/

The implementation of a dual and hybrid approach aligns with the aspirations of the South African Electronic Communications Amendment Bill of 2022, which recognises the importance of CNs as one of the complementary strategies for closing the digital divide. Furthermore, it supports zero-rated regulations and emphasises the need for innovative solutions to ensure affordable and accessible Internet connectivity for all citizens. The study proposes considering the development of Batho-centric infrastructure to facilitate and enable digital interactions without solely relying on Internet connectivity, while also aiming to ensure access to quality and affordable Internet.

Meso-level actors: this study recommends the integration of digital skills transfer through Mandhwane pedagogy, alongside andragogy and heutagogy learning methodologies, focusing on Generations Z and Alpha. Guided by the proverb rutang bana ditaola le se ye le tšona badimong (the intentional transfer of wisdom, knowledge, and skills to the younger generation), the study suggests a dual approach to digital skills development to address usage and access gaps, while also building contextual future capabilities. The study further suggests integrating mind mobilisation and ethical digital leadership into digital skills programmes, serving as the foundation for a citizen-led approach. Lastly, the study suggests moving beyond the generic application of Botho philosophy by engaging in context-specific cultural assessments to avoid relying on predetermined cultural frameworks that may not adequately consider how structures, historical legacies, and contextual ontologies, epistemologies, and axiology constrain or enable DT.

Micro-level actors: lastly, this study recommends that micro-level actors cultivate collective consciousness, guided by the proverb "Hlapi holofela leraga meetse a pšhile o a bona" to unlock collaboration and coordinated action to explore citizen-led and contextual DT ("fish trust in the mud, the water dried out while you were looking, the proverb means that when children are used to being provided for by their parents they become spoilt and when their parents die or become old, they are left in destitute when they have to work and provide for themselves" (Kgarose, 2020). The proverb "Tau tša hloka seboka di šitwa ke nare e hlotša" (lions that fail to work as a team, struggle to bring down even a wounded buffalo) is suggested to encourage micro-level structures to form strategic partnerships with meso-level organisations to unlock collective resources, skills, and influence in advocating policy changes that support grassroots efforts.

9.9 Conclusion: Towards a transformative, and innovative dynamic state and quality of being in the digital knowledge and learning economy

This study investigated the role of cultural knowledge systems in facilitating the active and inclusive participation of African rural communities in DT. The following conclusions can be drawn from the study:

a. Contextual DT is a dynamic process driven by the strategic integration and use of digital and non-digital technologies into ways of being, knowing, and doing. Ways of leading, environmental factors, and the interplay with psychological factors shape this integration. In this context, understanding how these elements collectively shape the experience of Batho in DT, and consequently, the DE is crucial.

b. The generic application of Botho philosophy as an indigenisation and contextualisation theory in ICT4D separates the entities of DT, encompassing human beings (Mu-NTU/Ba-NTU), temporal space and time (Ha-

NTU), digital and non-digital resources (Ki-NTUs), and quality and modality of being (Ku-NTU). This separation lays a foundation for excluding African rural communities in the digital era. Therefore, critically examining cultural frameworks such as Botho is essential to mitigate the risk of oversimplifying local ontologies and epistemologies.

c. Considering local ontologies, epistemologies, axiology, and language are crucial for an inclusive DKE. Understanding the philosophical underpinnings of cultural practices embedded in languages is critical to avoid reducing the entirety of Batho to automated and digitalised attributes with no contextual relevance and meaning.

d. The inseparability of knowledge from being and doing, as demonstrated in this study, requires a critical examination of knowledge in the digital economy. The critical question is: whose DKE is it?

e. Given the power dynamics stemming from historical legacies, wounded leadership, and the inadequate consideration of contextual CKPPs, the participation of communities in resource-constrained environments in the DKE is significantly hindered by systemic barriers, rather than solely by their lack of aspirations, skills, and innovative mindsets. Therefore, the study concludes that actors in the Global South have a better chance of fostering inclusive DT by leveraging their collective capabilities and intelligence, drawing guidance from the proverb "Tau tša hloka seboka di šitwa ke nare e hlotša" (lions that fail to work as a team struggle to bring down even a wounded buffalo).

The study concludes that adopting a holistic systems thinking and culturally embedded approach can potentially lead to transformative innovation in the digital knowledge and learning economy. However, this transformation requires creating an environment conducive to harnessing collective capabilities and intelligence, encapsulated by the concept of "Letšema." Additionally, there is a need for investment in Batho-centric infrastructure, integrating principles of duality and pluralism, alongside lifelong learning strategies. Lastly, the transformative and people-centred digitally connected transformation requires ethical leaders who are guided by Botho in adversity and informed by African canons.

While the study highlights the potential for transformative, people-centered change, it also acknowledges that such a transformation comes with its set of challenges. Scholars might critique this theory on several grounds, including the lack of empirical evidence beyond the context of this study, particularly regarding the effectiveness of holistic systems thinking and culturally embedded approaches in the broader digital knowledge and learning economy, as well as the practical difficulties of scaling such approaches. My response would be that we can never know the effectiveness without experimenting with the ideas, as a result, we cannot pre-emptively determine the outcome of the theory. We can only know if we are prepared to venture into uncharted territories where imagination and innovation are unconstrained by the fear of failure.

Furthermore, the theory advocates for an incremental and gradual approach guided by the proverb pšhiša madibana e pšhiša a magolo (small actions lead to big actions in the future), which emphasises the significance of addressing

small actions over time. Through this incremental and gradual approach, individuals and organisations can overcome barriers, tapping into Letšema collective capabilities and intelligence.

Building on the principles of openness to experimentation and imagination embedded in the DM-T, any future reality that we can theorise is possible. If many future realities are feasible today, based on current trends and dynamics in the digital economy, then this reality is also possible, and we can explore it. If human and non-human actors can create multiple futures, they are equally capable of shaping and creating the Digital Mandhwane future. The DM-T theory affirms the diversity of human realities, noting that Mandhwane is a reality in many South African and African villages and other resource-constrained environments.

9.10 Limitations of the study and the DM-T

The constructivist approach in this study implies that the findings are specific to the MTA. While the findings are specific to the MTA and do not seek to generalise African philosophy beyond this context, it is important to note that the study encountered several limitations during the data collection process. The study faced several limitations during the data collection process, particularly with the preliminary household survey, largely due to the COVID-19 pandemic and the initial perception that the survey was a government initiative. This perception led to scepticism among community members, who expected compensation in the form of food parcels for their participation. As a result, the response rate was lower than expected. However, despite these limitations, the validity of the study's findings remained robust, particularly in understanding the MTA's cultural framework. The majority of survey respondents had lived in the area their entire lives, providing rich insights into local cultural practices and processes, representing perspectives spanning over 61 years and multiple generations.

While the findings from the MTA provide valuable insights, it is also important to recognise that the broader application of the DM-T may encounter challenges when implemented in different contexts. The operationalisation of the DM-T could face several limitations when applied in various settings or environments. Firstly, the interconnectedness of NTU beings, along with communal ways of knowing, doing, and leading, could be undermined if the DM-T is applied from an etic (outsider) perspective, particularly when operating from lenses that marginalise non-Western knowledge systems. This limitation could result in the exclusion or misinterpretation of critical elements of the theory.

Secondly, the DM-T is based on principles of learning by doing and lifelong learning, which may not align with institutional frameworks that prioritise fixed timelines and predefined templates. This misalignment could limit its applicability in contexts that rely on more structured, time-bound approaches. The non-prescriptive and iterative nature of the DM-T limits the ability to report on and measure predetermined outputs and metrics. As a result, the DM-T promotes embedding DT into ways of thinking and integrating it as a fundamental part of the social phenomenon that drives community-centric transformation, rather than being treated as a project-based approach.

In addition, in resource-constrained environments, conventional DT strategies face numerous barriers, including limited resource allocation, infrastructure availability, and access to devices. In this study, for example, the agritech prototype was not developed due to resource constraints. Additionally, challenges arose during the prototype testing workshop, particularly concerning intergenerational tensions, power dynamics, and lack of access to smartphones. The lessons learned from the study highlight that implementing the DM-T may encounter similar obstacles. Therefore, to address these limitations, the DM-T advocates for a long-term, gradual implementation strategy that allows for adapting and overcoming these barriers.

9.11 Future research and narratives

Given the constructivist nature of this study, future research could explore comparative analyses across diverse cultural contexts to understand how cultural practices shape and facilitate DT in resource-constrained environments. In this regard, the theoretical framework emphasises contextual understanding while remaining adaptable across various cultural settings, enabling researchers to investigate the role of cultural practices in promoting inclusive and active DT. Building on this, scholars could further examine the communal framework of being, knowing, doing, and leading within their own contexts, aligned with their unique epistemologies, ontologies, and axiologies. As the Igbo proverb says, “Nku di na mba naeghere mba nri” (firewood in a particular context is good enough for cooking in that environment). Furthermore, future studies might also explore how non-digital practices can serve as catalysts for the transition to a DKE, particularly through intergenerational learning frameworks that bridge digital skills development with cultural heritage. Additionally, researchers should consider how African thought systems, such as those found in the Imagined Village model, can inform community-centric digital infrastructure, addressing both offline and online solutions in resource-limited settings.

Lastly, within the framework of social constructivism, reality and meaning making emerge from collaborative efforts and multiple perspectives. The construction of reality in this study prompts reflecting on the question: Who is the intended audience for this research? In other words, for whom is the researcher writing for? Instead of prescribing the audience, this study invites individuals interested in exploring the interplay between local ontologies, epistemologies, axiology, and their potential role in laying the foundation for non-prescriptive and non-descriptive contextual DT in an African context. The study encourages individuals to construct, reconstruct, and deconstruct the presented narrative, aligning with the ontological stance that there is no single reality. Thus, the reality of the DM-T is dynamic and context-dependent, shaped by the diverse perspectives and interpretations of those engaged in the process, and continuously evolving as a social construct within the African context.

9.12 Last word: Spiritual and ancestral reflections

I am a descendant of ancestors who were among the early converts to Christianity through the Medingen Mission station of the Berlin Missionary Society, under Reverend Fritz Reuter (Mokgoatsana & Sebola, 2022). In the early 1800s, most people in Bolobedu were unfamiliar with Christianity, but through repentance and conversion, one could

acquire both spiritual and educational enlightenment. Included in the group that studied at Medingen included my forefather, Motshekga accompanied by his brothers Maepa, Makgwana and Ramafalo.

As Berlin Mission graduates, their baptism led to the adoption of Christian names, symbolising a rejection of ancestral worship and a significant cultural shift. This act served as confirmation that ancestral worship and beliefs had been abandoned, signalling a clear departure from their previous practices. Consequently, the epistemic violence imposed upon my ancestors by the German missionaries implies that I come from a lineage of people who were forced to relinquish their ways of being, knowing, and doing, to seek "light" and "education". This historical shift in my family's path marked the beginning of a complex transformation, one that led to a profound loss but also opened new doors. I see the decision of my ancestors as both a loss and a blessing. A loss because it has created multiple knowledge gaps about my cultural heritage. Yet, as a blessing, it has laid a foundation for me to be able to pursue this study.

Despite these historical complexities, ontologically, I have always understood my existence as embodying the spiritual essence of my ancestors. My ancestral and spiritual name, Moyahabo, symbolises the interconnectedness of Motho (human being) with Ha-NTU (home) and Batho in their relational state of being. Thus, the name Moyahabo signifies Yena wa hoya ha habo (the one who went home).

- **Mo** represents the state of being Motho (human being),
- **Ya** symbolise the state of being in motion (going to),
- **Ha** denotes temporal space and time (home), and
- **Bo** signifies the place where one's people are.

Metaphorically, the name Moyahabo, within the context of this study, transcends to represent a perpetual guiding force; symbolising the continuous journey (go ya) toward a transformative and innovative dynamic state of being in the digital knowledge and learning economy. Consequently, this study has been a transformative experience that has empowered me to consistently reflect on my being, knowing, doing, and leading, including my woundedness. These elements collectively shape my pursuit of a dynamic and innovative state of being in the digital knowledge and learning economy.

> Agee Kolobe wee!
> Motho wa Bo Mafalo mafal'a ntlong. Mokoto a fala ka Naka la pula e a na.
> Ke nna motho wa bo Mohale Motshekga.
> Motho wa bo Moyahabo Kgatla le Mašepetla Motshekga.
> Vathu vha Mutsika Mowoto Mutsiki wa Vathu, Dikolobe tša Leote.
> Valozwi BakhalakaVhana vha Tjie Khalaka.
> Vathu vha vho Bo Mafalo mafal'a ntlong, Mokoto a fala ka Naka la pula e a na.
> Agee Kolobe wee!

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APPENDICES

Appendix A: Critical discourses with ICT4D and CI experts

From: Ditshego Magoro [mailto:Ditshego.Magoro@treasury.gov.za]
Sent: 20 January 2016 12:24
To: ciresearchers@vancouvercommunity.net
Subject: Community informatics and needs analysis

Dear CI researchers,

I am looking for case studies/research papers that focused on the review of participatory methodologies applied within the context of ICT4D projects.
I would like to determine what methods contributed towards the attainment of effective usage of ICT interventions by the targeted communities.

I have observed that most of the ICT4D case studies/research often cite poor/lack of community participation as one of the contributing factors that leads to poor project outcomes.

Questions

- Has anyone of you conducted a review of how this participatory methods have been applied in the planning and management of ICT4D projects?
- Given the failure of ICT interventions (South Africa), how can ICT4D practitioners ensure effective usage?
- What are the guidelines and tools that could be applied to ensure bottom-up community broadband initiatives? Is it even possible to apply a bottom – up approach in such initiatives?

I am looking forward to your inputs.

Regards
Ditshego Magoro

From: ciresearchers-owner@vancouvercommunity.net [mailto:ciresearchers-owner@vancouvercommunity.net] **On Behalf Of** Ditshego Magoro
Sent: 04 March 2016 12:53
To: gurstein@gmail.com; ciresearchers@vancouvercommunity.net
Cc: alutamagoro@gmail.com
Subject: [ciresearchers] In search of a theoretical framework for ICT4D/CI

Dear colleagues,

Most scholarly articles on ICT4D/ CI research indicate that the sector is fragmented and lacks a theoretical foundation. This has resulted in divergent views and approaches when investigating ICT4D or when planning and implementing projects. After reading so many articles about this lack of theoretical foundation, I came across an article by Larry Stillman and Henry Linger (***Community Informatics and Information Systems: can they be better connected?***).

This reading happened after data collection and initial analysis for my Masters on ICT Policy and Regulation. At the start of my research and literature review, I incorporated connectivity model as one of the variables, but at that point the intention was just to determine the technology tool used in the identified projects, without necessarily interrogating it. I discovered that all the eight case studies in my research used VSAT. My research questions to the participants focused on understanding their experience with the provided connectivity. My supervisor challenged me to unpack the technology aspect. This became a learning opportunity because it meant I must engage with people who can explain how VSAT work, the requirements that must be satisfied before such a technology can be deployed and the monitoring & evaluation. I managed to speak to SENTECH and Meraka Institute of Science and Technology to ensure that I get a balanced explanation.

The interaction with VSAT specialists helped me to understand the challenges experienced by the research participants from a technical point of view. For example, I was in a better position to contextualise why some users will wait for 12 hours for a document to download. I was in a position to understand why a community centre with 13 connection points failed to perform when all thirteen users were online. I also got to understand why one community centre could benefit from three different connectivity interventions provided by three different institutions using the same technology and all funded by one source (public funds).



The recommendations by my supervisor and the Linger & Stillman article provided a fresh perspective and strengthened my research on rural connectivity. I think it made me to be more interested on the technology design and implementation without losing track of the social issues associated with technology. By understanding VSAT, I got to realise that internet connectivity and broadband is a moving target because usage by the beneficiaries changes with their level of maturity or exposure to applications that requires more data. This means that at the beginning of a project one can deploy appropriate technology that is aligned to the basic needs of surfing the net, but as time goes on, the technology could become inappropriate. Therefore there is a need for on-going technology upgrade, engagement between technology designers and the social scientists to ensure systems performance and effective usage.

> *"The dual agenda addresses equally both its community problem-solving agenda and its information systems problem-solving agenda. To address this dual agenda, CI needs to develop a theoretical position that recognises the inherent dialectical relationship between these agendas" (Linger and Stillman, 2009).*

For some reason I am convinced the dual agenda could add value to the current waste we see in the ICT4D. So I am wondering if anyone has applied the dual agenda approach proposed by Linger and Stillman.

And then going back to the fragmentation of ICT4D and the lack of a theoretical framework, I have the following questions:

1. Who is supposed to take the lead or drive the development of the coherent framework?
2. What has been done to close the gap?
3. How long are we going to keep on mentioning the theoretical gap?
4. What is the impact of the existing divergent views/theories on ICT4D/CI research?

I hope it makes sense.....

Regards
Ditshego Magoro

Fwd: [ciresearchers] Broadband for All (BB4All) and Siyakhula Living Lab

---------- Forwarded message ----------
From: **Ditshego Magoro** <Ditshego.Magoro@treasury.gov.za>
Date: 12 May 2016 at 10:19
Subject: [ciresearchers] Broadband for All (BB4All) and Siyakhula Living Lab
To: ciresearchers@vancouvercommunity.net, Michael Gurstein <gurstein@gmail.com>
Cc: smiley@siyafundactc.org.za

Hi all,

I am looking for information on the status of the Broadband for All (BB4All) initiative by the CSIR and the Siyakhula Living Lab.

What are the outcomes and impact of the projects?

Smiley, you can also share the Siyakhula experience (outcomes and impact) if you do not mind . You have mentioned that the project has been successful. I would like to know how do you go about measuring success.

Regards

Ditshego Magoro

RE: Facilitating Policy Implementation using ICT in a Development Context: A South African Ubuntu Approach

TH Twinomurinzi, Hossana <twinoh@unisa.ac.za>
To: Ditshego Magoro <Ditshego.Magoro@treasury.gov.za>
Thu 5/5/2016 10:49 PM

The missing IT artefact.pdf
2 MB

Dear Ditshego,

Thanks for the inquiry. I have attempted to respond below inset.

I believe you are on the right track in seeking African answers. There are a growing number of literatures on how Africa works which can be drawn from.

Regards,

Hossana

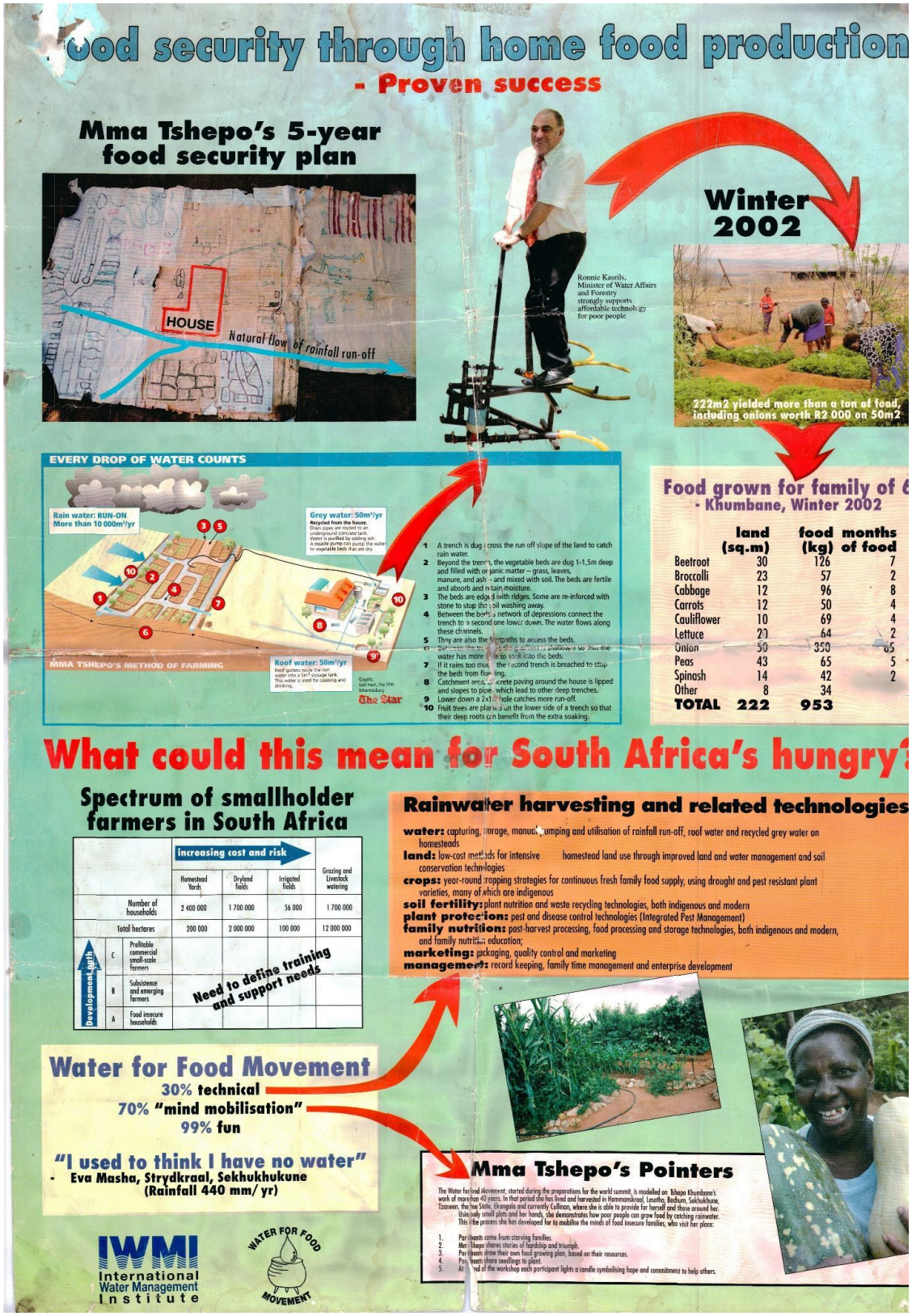
On May 5, 2016 11:14 AM, Ditshego Magoro <Ditshego.Magoro@treasury.gov.za> wrote:

Dear Prof Hossana,

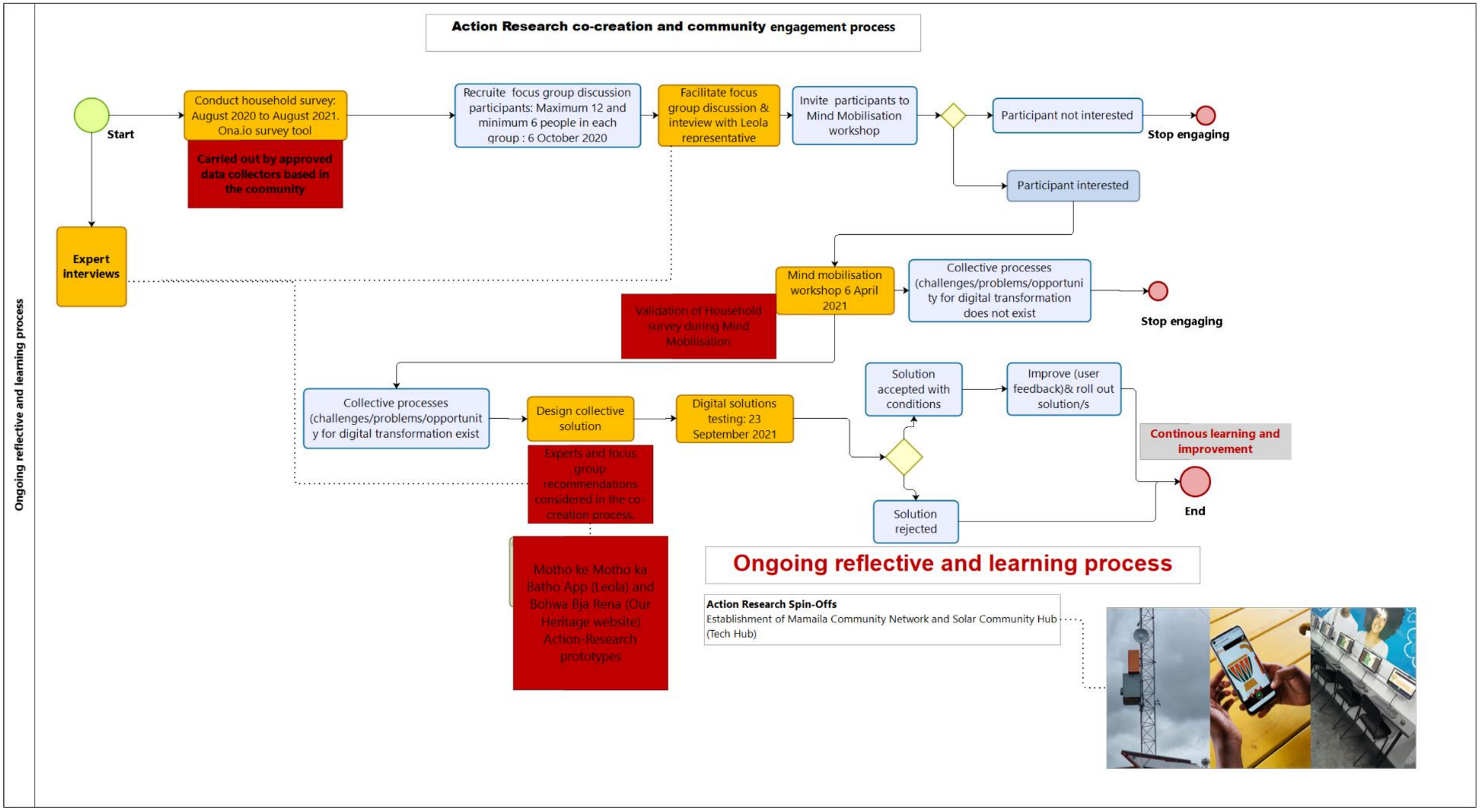
I am reading with interest your thesis titled **Facilitating Policy Implementation using ICT in a Development Context: A South African Ubuntu Approach.** I am fascinated by the application of the Ubuntu Development Framework (UDF) to the research. I would like to know if any scholars have attempted to apply the framework in a real life project and how is the theory received by the ICT4D scholars.

No scholars that I know of – though it has been cited a couple of times in e-government research.

Appendix B: Khumbane's integrated and holistic approach to food security and water resources management



Appendix C: Community engagement process



Appendix D: Example of moderator guide for semi-structured interviews

ANNEXURE G: CULTURAL EXPERT: SEMI-STRUCTURED INTERVIEW

Working definitions

Cultural knowledge systems: A people's way of doing and being (transferred from one generation to another as part of their culture) to achieve their socio-economic needs/aspirations. **Digital transformation:** a process and approach applied by rural communities such as Mamaila by leveraging digital technologies in order to support their day-to-day individual/household and community processes to enable their socio-economic advancement. **Digital economy:** refers to an economy that leverages digital technologies as the foundation of its products, services, operations, customer interaction and overall business model (Davidovski, 2018).

ICE-BREAKER:MY ROOTS

Tell me about yourself (name, surname, family praise/totem and what it means to you? Purpose of this question is to facilitate a discussion that encourages participants to reflect on their roots and preparing them to operate within an Afrocentric worldview.

A) Why is your totem and praise song important?
B) Where did you learn about your totem and praise song?
C) What are the key messages embedded in your totem and praise song?
D) How is this relevant in today's life? Is it applicable and if so how do you apply it in your day to day life?

Q1: CULTURAL KNOWLEDGE SYSTEMS, PRACTICES AND PROCESSES: How do deeply embedded cultural practices unlock collective human capabilities for inclusive digital adoption and usage?
Q2: DIGITAL ADOPTION AND USAGE : How can a culturally embedded approach facilitate digital adoption and usage for rural socio-economic advancement?
Q3: DIGITAL SKILLS: To what extent do culturally embedded knowledge systems facilitate digital skills required for active participation in the digital economy?
Q4: DIGITAL INFRASTRUCTURE: What is the appropriate digital infrastructure to facilitate localized solutions for inclusive digital transformation?
Q5: DIGITAL LEADERSHIP: How can digital leadership facilitate a people-cantered digitally connected development?

Appendix E: Focus group moderator guide

MODERATOR GUIDE FOCUS GROUP DISCUSSION:TRIBAL AUTHORITY

FOCUS GROUP DISCUSSION TRIBAL OFFICE OFFICIALS RESPONSIBLE FOR PLANNING AND COMMUNITY DEVELOPMENT: TARGET NUMBER IS 6 TO 12

Working definition

Cultural knowledge systems: A people's way of doing and being (transferred from one generation to another as part of their culture) in order to achieve their socio-economic needs/aspirations. **Digital transformation:** a process and approach applied by rural communities such as Mamaila by leveraging digital technologies in order to support their day to day individual/household and community processes to enable their socio-economic advancement. **Digital economy:** refers to an economy that leverages digital technologies as the foundation of its products, services, operations, customer interaction and overall business model (Davidovski, 2018).

ICE-BREAKER:MY ROOTS

Tell me about yourself (name, surname, family praise/totem and what it means to you? Purpose of this question is to facilitate a discussion that encourages participants to reflect on their roots and preparing them to operate within an Afrocentric worldview.

A) Why is your totem and praise song important?
B) Where did you learn about your totem and praise song?
C) What are the key messages embedded in your totem and praise song?
D) How is this relevant in today's life? Is it applicable and if so how do you apply it in your day to day life? And how do you apply it?
E) What role do you play at the Tribal office and how long have you been here?
F) Why is it important for you to do what you do?

Q1: HOW DO DEEPLY EMBEDDED CULTURAL PRACTICES UNLOCK COLLECTIVE HUMAN CAPABILITIES FOR INCLUSIVE DIGITAL ADOPTION AND USAGE? The purpose of this question is to have a dialogue about the communal cultural knowledge systems, processes and practices (CKSPP) within the village.

A) What are there any cultural knowledge systems, processes and practices that are facilitated by the Tribal Office?
B) If yes; name them and explain how the cultural knowledge systems, processes and practices (social, economic, political etc.) are applied by community members in order to achieve their personal goals?
C) If, no; what is your childhood memory of any cultural knowledge systems, processes and practices in this village? What are the stories that you have heard about your culture?

MODERATOR GUIDE FOCUS GROUP DISCUSSION:TRIBAL AUTHORITY



D) What are the historical locations in this village and what is their role in the community?
E) Where did you learn about CKSPP?
F) Who transferred the CKSPP to you?
G) Does the community have any rules that govern farming activities, if so, what are the rules and what is the role of the rules? Or community financial related activities?
H) What is the role of the municipality in ensuring that the plan is implemented? And what is the role of the community?
I) What are the key events that are celebrated in the community? What is the name and purpose of each event?Seasonal calendar

Local economy
Does the Tribal Office have a community development plan? If yes, can I get a copy? How do you go about developing your plan and how do you decide what to put in your plan? What is the relationship between the Tribal Office and Greater Letaba Municipality? What is their role in ensuring that you achieve your plans?
If you could have four things to develop in your community which are the four things you would choose and in what order? Why are they important to you and the community?
What type of businesses exist in the community?
What type of social support networks exist in your village?
Are there any groups, organisations, associations, cooperatives in the village? And what is their purpose?
Do you know of any influential or knowledge people in the village (health, business, agriculture, financial management, technology etc
What are the existing assets in the community which you think could contribute to cultural preservations, digital skills development, adoption and usage of digital skills as well as advancing people's socio-economic aspirations?

Q2: DIGITAL ADOPTION AND USAGE : How can a culturally embedded approach facilitate digital adoption and usage for rural socio-economic advancement?

A. Do you have access to computers at the Tribal Office?
B. Do you have access to the Internet? If yes, what do you use it for?
C. Does the Tribal Office have a website and email address?
D. How does the Tribal Office communicate and disseminate messages targeted at the community?

Q3: DIGITAL SKILLS: To what extent do culturally embedded knowledge systems facilitate digital skills required for active participation in the digital economy?

A. How many people are employed at the office?

MODERATOR GUIDE FOCUS GROUP DISCUSSION:TRIBAL AUTHORITY



B. Did they receive any computer training? If yes, where?
C. Do they have access to the internet? If yes, how do they use it to support their work?
D. If not using it, what are the reasons?

Q4: DIGITAL INFRASTRUCTURE: What is the appropriate digital infrastructure to facilitate localized solutions for inclusive digital transformation?

E. Are they any computer centres in this village? Or at schools connected to the internet?
F. What is the level of mobile ownership in the community?
G. What do you think is the role of CKSPP in the design and development of appropriate digital infrastructure?

Q5: DIGITAL LEADERSHIP: How can digital leadership facilitate a people-cantered digitally connected development?

H. What is the role of the Tribal Office in ensuring that the village has access to digital infrastructure?
I. What are the steps that you have taken to ensure people have access to digital infrastructure?
J. Who are the stakeholders that you are working with in this regards and what has been the outcome?

Appendix F: Mind mobilisation community workshop

TLHAHLO YA MOSEPEDIŠI: KOPANO-FAHLOšO YA TUKIšETšO YA MONAGANO



TLHAHLO YA MOSEPEDIŠI: KOPANO-FAHLOšO YA TUKIšETšO YA MONAGANO

A) Bakgathatema ba mengwa go tšweletša pego ya bona ya tshekatsheko ya seemo. (Go swanetše go gata ka boya ka ge batho ba ka no se nyake go abelana dintlha lebaka e le phadišano yeo e ka nobago gona. Mosepediši o swanetši o hwetša tsela yeo e bolokegilego ya go fana ka pego morago ntle le go bea bakgathatema ka fase a kgatelelo. Tabakgolo ke go hlatha mafelo ao a kano hlokago go tsenelela a titšithale ka tsela yeo e swanago).
Ka gore yalo, bakgathatema ba diriša mekgwanakgwana ya pontšho go ngwala dikganyogo tša bona tša leago le boiphedišo.Diphoustara le dikarata di tlo lekeletšwa le go kgomaretšwa lebotong gore dihlopha di naganišiše ka tšona ntle le go bea leihlo batho bao ba itšego, ntle le ge e le gore ba rata go abelana phatlalatša.

B) Dihlopha di botšišana dipotšišo ka maikemišetšo a go ithuta ka go naganišiša mmogo bjalo ka seboka ka boemo bjo bo lego gona bja ditaba (go seo ba se bonago diphoustareng). Bao ba nago le kgahlego ya go abelana dikanegelo tša bona ba mengwa go dira bjalo.

C) **Moanegi:** Nea kholofelo (hlohleletšo gotšwa go molemi yo a diragatšago phetogo ya titšithate (mararankodi a theknolotši).

D) Bakgathatema ba hlama leano la bona la phetogo ya titšithale; Se ke seo Mmatshepo a se bitšago 'Helicopter plan' ka seisimane. Se se fa bakgathatema leano la go kwešišega le ditiro tša go bonagala tšeo ba di hlokago go phethagatša gore ba kgone go fihlelela morero wa bona. Mosepediši le bakgathatema ba hlatha mafelo ao a swanago gore ba kgone go hlatha le go dumelelana go tharollo ya titšithale ka seboka yeo e ka phethagatšwago ke molemi yo mongwe le yo mongwe, eupša ba ithuta mmogo le go kaonafala bjalo ka seboka.

Appendix G: Seasonal calendar moderator guide

MODERATOR GUIDE : SEASONAL CALENDAR- AGRICULTURE



Objective: The purpose of this activity is to gain an understanding of events happening in the community in relation to cultural knowledge systems, processes and practices. The information gathered from this activity will enable the researcher and participants to identify processes and practices that might benefit from digitalization.

Moderator welcomes participants and remind them of the focus group discussion that they participated on. Moderator explains that information from the seasonal calendar will be used to identify practices, processes and events that might require digitalisation.

Seasonal calendar activity (facilitator asks participants to participate in a seasonal calendar activity and initiate a dialogue on the documented calendars. Explain to participants that we would like to know about the agricultural activities in this village, what crops do they plant, what are the activities that are associated with farming (Activities such as preparing field to harvesting and selling), and in which months in a year they conduct these activities. First ask participants to name the main seasons of the year in the village. Reference to weather patterns and key community events. Write down months of the year under each season. Ask also about other activities related to livestock (such as rearing cattle, goats, chickens, and pigs). Ask them to write, draw a picture, or symbolize these activities on the table:

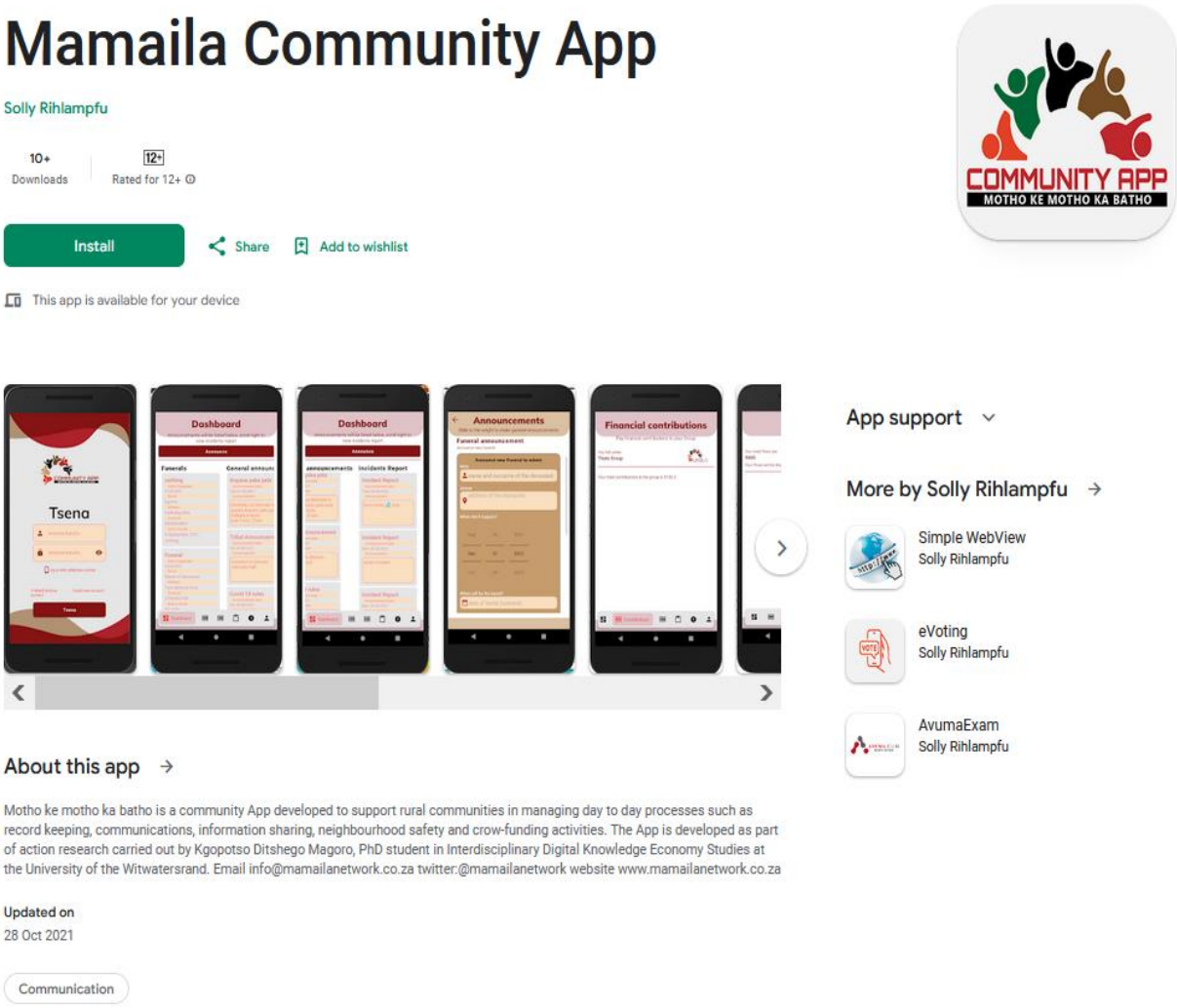
- Preparing field for planting (cutting trees, building shelter, etc.)
- Growing crops
- Weeding
- Harvesting
- Selling/bartering harvested crops
- Rearing livestock (cattle, goat, pig, chicken, etc)

After participants have finished with agriculture-related activities, ask if in this village people also go to the forest. If yes, ask participants to write, draw a picture or symbolize activities that they do in the forest and collect/ gather forest products and identify in which months in a year they do these activities.

After participants have finished with forest-related activities, ask about cultural, social, customary or religious celebrations: what cultural, social, and religious events celebrated by the villagers and in which months in a year these celebrations happen.

Addapted:https://www1.cifor.org/fileadmin/subsites/pmrv/documents/3_PMRV_FGD_Seasonal_calendar_170913_English.pdf

Appendix H: Motho ke motho ka batho community app



Appendix I: Household survey Sepedi questionnaire

NYAKIŠIŠO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIŠO, DITIRO LE DITSELA TŠA TSEBO YA SETŠO LE MEKGWA YA BATHO GO PHETHOGO YA TITŠITHALE: E SWANETŠI O TLATŠWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

TSHEDIMOŠO YA MOKGATHATEMA			
D.1	Bong:	[4] Mosadi	
		[4] Monna	
		[4] Tše dingwe	
D.2	Mengwaga:	[1] 18 - 25	
		[2] 25- 39	
		[3] 40- 54	
		[4] 55-75	
D.3	Bodumedi:	[1] Mokriste	
		[2] Tumelo ya SeAfrika	
		[3] Mamoseleme	
		[4] Tše dingwe	
D.4	O fihlile kae ka dithuto:	[1] Ga gona	
		[2]Dithuto tša fase (primary)	
		[3]Dithuto tšeo di phagamego (secondary)	
		[4] Diploma/certificate	
		[5] Bachelors	
		[6] Masters	
		[7] PhD	
D.5	Ke mediro e feng ye o be go tshwaraganeng le yona di kgweding tše tshela (6) tša go feta	[1] Moithuti/Morutwana	
		[2] mošomo wa ka gae wa go se patele (unpaid house work)	
		[3] rotše modiro (retired)	
		[4] go tsomana/nyakana le mošomo (unemployed seeking a job)	
		[5] ga o šome ebile ga o tsomane le mošomo (unemployed not looking for job)	
		[6] o golofetše ebile o palelwa ke go šoma (disabled and unable to work	
		[7] thwetšwe go mošomo wa go patela (employed - salary/wages)	
		[8] Wa ipereka ebile o na le bašomi (self-employed with employees)	
		[9] Wa ipereka ebile ga wa thwala motho (self-employed without employees)	
D.6	Ke nako (mengwaga) ye kaakang o dula mo motseng.	[1] Ka fase a mengwaga ye 5 (less than 5 years)	
		[2] 10 - 15	
		[3] 15- 20	
		[4] 20- 30	
		[5] Bophelo ka moka (Whole life)	
	MATSENO A GO DIRA GORE BAKGATHATEMA BA LOKOLOGE: LEŠIKA LA LAPA: GA SE KGAPELETŠO		
	Mpotše ka wena (leina, sefane, moeno/seroto sa lapa le gore se ra go reng go wena? Go reng go le bohlokwa go wena go ditseba? O ithutile kae ka tšona ebile ke mang yo a o rutilego ka tšona? O netefaditše bjang gore o wa di tseba?).		
CPP	**DITIRO LE DITSHEPEDIŠO TŠA SETŠO**		
CPP.1	Ke ditiragalo le ditshepedišo dife tša setšo tšeo o di tsebago mo setšhabeng? Hle swaya mabokisi a mmalwa goya tsebo ya gago.	[1] Go phasa (libation)	
		[2] Koma/modha	
		[3] Kgopa	
		[4] Dithalwa le dibetlwa	
		[5] Aretsebaneng	

NYAKIŠIŠO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIŠO, DITIRO LE DITSELA TŠA TSEBO YA SETŠO LE MEKGWA YA BATHO GO PHETHOGO YA TITŠITHALE: E SWANETŠI O TLATŠWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

		[6] Motšhelo	
		[7] Tšhireletšego ya dijo (go di šila goba go difetoša goya go mohuta wo mongwe wa sejo le go di lota)	
		[8] Thuto ya SeAfrika ya tlhago le legohle (tšhupamabaka)	
		[9] Mantlwane (go ithuta ka go dira))	
		[10] Lebele (grocery insurance system for funeral purposes	
		[11] Malopo	
		[12] Dinonwane (Folk tales)	
		[13] Ditiro tša go nesa pula	
		[14] Dipapadi (diketo,kgati)	
		[15] Magadi (Lobola)	
		[16] Lehola	
		[17] Letšema	
		[18] Go ilela	
		[19] Go lema	
		[20] Go diša	
		[21] Tše dingwe	
CPP.2	Ke ditiragalokgolo dife tša setšo tšeo diphethwago ka lapeng la geno le setšhabeng ka bophara? Hle swaya mabokisi a mmalwa goya tsebo ya gago.	[1] Go phasa	
		[2] Koma/modha	
		[3] Kgopa	
		[4] Dithalwa le dibetlwa	
		[5] Aretsebaneng	
		[6] Motšhelo	
		[7] Tšhireletšego ya dijo (go di šila goba go difetoša goya go mohuta wo mongwe wa sejo le go di lota)	
		[8] Thuto ya SeAfrika ya tlhago le legohle (tšhupamabaka	
		[9] Mantlwane	
		[10] Lebele	
		[11] Malopo	
		[12] Dinonwane	
		[13] Ditiro tša go nesa pula	
		[14] Dipapadi (diketo,kgati)	
		[15] Magadi (Lobola)	
		[16] Lehola	
		[17] Letsema	
		[18] Go ilela	
		[19] Go lema	
		[20] Go diša	
		[21] Tše dingwe	
CPP.3	E kaba o tseba melao ya setšhaba yeo e dirišwago ke mošate go netefatša gore batho ka moka mo setšhabeng ba šoma mmogo ka maikemišetšo a go dira gore setšhaba se phele ga botse? Hle swaya mabokisi a mmalwa goya tsebo ya gago.	[1] Motšhelo	
		[2] Lehola	
		[3] Diphiri	
		[4] Go ilela	

NYAKIŠIŠO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIŠO, DITIRO LE DITSELA TŠA TSEBO YA SETŠO LE MEKGWA YA BATHO GO PHETHOGO YA TITŠITHALE: E SWANETŠI O TLATŠWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

		[5] Tše dingwe		
CPP.4	Ke a dumela gore theknolotši e ka thekga/kgontšha ditiro le ditshepedišo tša setšo sa rena	[1] Ke a gana [2] Ke gana ke tiišitše [3] Ke a dumela [4] Ke dumela ke tiišitše		
CPP.5	Ditiro le tshepedišo yaka ya setšo e na le seabe go tša boiphedišo bja tikologo le go dira letseno.	[1] Ke a gana [2] Ke gana ke tiišitše [3] Ke a dumela [4] Ke dumela ke tiišitše		
CPP.6	Ke ithutile ka ditiragalo le ditshepedišo tša setšo ka (Hle swaya mabokisi a mmalwa goya tsebo ya gago.).	[1] Gae [2] Sekolong [3] TV [4] Inthaneteng [5] Mantlwane [6] Tše dingwe		
CPP.7	Tshedimošo ka ditiro le ditshepedišo tša setšo saka e hwetšegala ga bonolo go inthanete. Hle swaya mabokisi a mmalwa goya tsebo ya gago.	[1] Ke a gana [2] Ke gana ke tiišitše [3] Ke a dumela [4] Ke dumela ke tiišitše		
CPP.8	Nka diriša inthanete kudu ge e le gore gona le diteng ka ditiro le tshepedišo ya setšo saka le tshedimošo ka motse wa gešo.	[1] Ke a gana [2] Ke gana ke tiišitše [3] Ke a dumela [4] Ke dumela ke tiišitše		
CPP.9	Nka diriša inthanete kudu ge e le gore gona le diteng ka ditiro le tshepedišo ya setšo saka le tshedimošo ka motse wa gešo yeo elego ka polelo laka.	[1] Ke a gana [2] Ke gana ke tiišitše [3] Ke a dumela [4] Ke dumela ke tiišitše		
SINP	**KGOKAGANO YA LEAGO, MOSEPELO WA TSHEDIMOŠO LE DITIRO TŠA KGOKAGANO**			
SINP.1	O nyalelana bjang le batho ba motse wa geno? Hle, laetša gore o wa dumela goba o ganetšana le dipolelwana tšeo di latego.	A. Bontši bja batho bao ke ba tsebago bo dula kgauswi le nna ebile bo a tsebana.	[1]Ke a gana	
			[2] A kena bohlatse	
			[3] Ke a dumela	
		B. Ke tseba batho bao ba godišitšwego go fapana le nna.	[1] Ke a gana	
			[2] A kena bohlatse	
			[3] Ke a dumela	
		C. Ke rata goba ke le tee.	[1] Ke a gana	
			[2] A kena bohlatse	
			[3] Ke a dumela	
		D. Ke hwetša bagwera ba baswa ka pela gongwe le gongwe mo ke sepelago.	[1] Ke a gana	
			[2] A kena bohlatse	

NYAKIŠIŠO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIŠO, DITIRO LE DITSELA TŠA TSEBO YA SETŠO LE MEKGWA YA BATHO GO PHETHOGO YA TITŠITHALE: E SWANETŠI O TLATŠWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

			[3] Ke a dumela	
		E. Ke rata go ba setho sa sehlopha/seboka sa tshepedišo ya setšhaba.	[1] Ke a gana	
			[2] A kena bohlatse	
			[3] Ke a dumela	
		F. Setšhaba sa rena se dumela go Ubuntu (botho).	[1] Ke a gana	
			[2] A kena bohlatse	
			[3] Ke a dumela	
		G. Ke ithuta bokaone ka gare a sehlopha.	[1] Ke a gana	
			[2] A kena bohlatse	
			[3] Ke a dumela	
SINP.4	O fela o eya medirong ya setšhaba? Hle swaya mabokisi a mmalwa goya tsebo ya gago.	[0] A ke ye		
		[1] Mahu/Polokong		
		[2] Maputha		
		[3] Koma		
		[4] Dikgopa		
		[5] Manyalo		
		[6] Mahola		
		[7] Dinaka		
		[8] Sekgapa		
		[9] Kgoro		
		[10] Tše dingwe		
SINP.5	Ke batho/mekgahlo e fe yeo o bolelago le yona ge o hloka maele goba tshedimošo go taba malebana le: Setšo, theknolotši,dibaka tša kgwebo, maphelo, ditshelete, temo goba taba yengwe le yengwe yeo elego bohlokwa go wena?`	Motho: Leina & sefane [0] None		Mokgahlo: Leina & sefane [0] None
		[1] Setšo (Culture):		[1] Setšo (Culture):
		[2] Ditšo (Traditions):		[2] Ditšo (Traditions):
		[3] Theknolotši:		[3] Theknolotši:

NYAKIŠIŠO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIŠO, DITIRO LE DITSELA TŠA TSEBO YA SETŠO LE MEKGWA YA BATHO GO PHETHOGO YA TITŠITHALE: E SWANETŠI O TLATŠWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

		[4] Dibaka tša kgwebo:	[4] Dibaka tšakwebo:
		[5 Maphelo:	[5 Maphelo:
		[6] Tše dingwe:	[6] Tše dingwe:
SINP.6	Naa o ka ba o tseba ka ga bolwetši bja Coronavirus?	[1] Ee	
		[2] Aowa	
SINP.7	O tsebile bjang ka ga bolwetši bja Coronavirus?	[1] Social networking apps (Facebook, WhatsApp, Instagram, Snapchat, Twitter, LinkedIn	
		[2] SMS	
		[3] TV	
		[4] Radio	
		[5] Newspaper	
		[6] Church	
		[7] Community meeting	
		[8] School	
		[9] Family	
		[10] neighbour	
SINP.8	Naa o hwetša kae ditaba le hlahlo ya maphelo ka ga bolwetši bja Coronavirus?	[1] Social networking apps (Facebook, WhatsApp, Instagram, Snapchat, Twitter, LinkedIn	
		[2] Government SMS	
		[3] TV	
		[4] Radio	
		[5] Newspaper	
		[6] Family	
		[7] Neighbour	
		[8] Other	
SINP.9	Ke tsaba ka ga WhatsApp ya COVID-19 yeo e thomilwego ke mmušo wa Afrika Borwa	[1] Ee	
		[2] Aowa	
SINP.10	Ge o ka ba otseba ka yona o fela o e berekiša?	[1] Ka di nako ka moka	
		[2] Ka nako ye ngwe	
		[3] Ga se ka ka e berekiša	
SINP.11	Ke tsaba ka ga letlaka la inthanethe leo le thomilwego ke mmušo wa Afrika Borwa	[1] Ee	
		[2] Aowa	
SINP.12	Ge o ka ba otseba ka yona o fela o e berekiša?	[1] Ka di nako ka moka	
		[2] Ka nako ye ngwe	
		[3] Ga se ka ka e berekiša	
SINP.13	Methopo yeo ke e tshapago ya go bea ditaba le maele a maphelo seemong sa Coravirus ke ye le latelago (berekiša sekala sa 1-5 kgetha go ya ka mothopo wa go tshepago go feta e mengwe)	[1] WhatsApp group	
		[2] Twitter	
		[3] Facebook	
		[4] Radio	
		[5] TV	

NYAKIšIšO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIšO, DITIRO LE DITSELA TšA TSEBO YA SETšO LE MEKGWA YA BATHO GO PHETHOGO YA TITšITHALE: E SWANETšI O TLATšWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

	[1] Ga ke e tshepi [2] Ke na le go se etshepe [3] Ge ke boemagare [4] Ke e tshepa gannyane [5] ke e tshapa kudu	[6] Newspaper	
		[7] Government	
		[8] Google	
SINP.14	Methopo ya gago ya tshedimošo ke e fe: Hle swaya go ya le ka tatelano ya methopo yeo o e dirišago kudu. (Hle ela ka sekala sa 1 go fihla go 8. 1 ke yeo e sa dirišwigo kudu mola 8 e le yeo e dirišwago kudu.	[1] Kantoro ya mošate (Tribal office)	
		[2] Kopano ya setšhaba (Community meeting)	
		[3] Ditsebišo ka dirapeng	
		[4] Mabarebare	
		[5] Mokgwera	
		[6] Seyalemoya sa Setšhaba	
		[7] Kuranta ya setšhaba	
		[8] Tše dingwe	
SINP.15	Ke ka tsela efe fao dikgokagano tša leago, dikgokagano (communication) le ditiro tša dikgokagano (network) tša setšo di go thušago go fihlelela merero ya gago ya boephedišo?	[1] Ga gona	
		[2] Go bopa dikgokagano tša kgwebo ka ntle a motse	
		[3] Go kgoboketša tšhelete go lapa/setšhaba	
		[4] Go ikgokagantša le dikgokagano tša ka ntle ga motse	
		[5] Go rekiša ditšweletšwa	
		[6] Go bopa dikgokagano tša kgwebo ka ntle a motse	
		[7] Tše dingwe	
SETšO LE THEKNOLOTšI			
CT.2	Theknolotši e bohlokwa go bophelo bjaka gobane e nthuša go (Hle swaya tše mmalwa goya le ka fao di lego bohlokwa go wena).	[1] kgokagana le mašaka le bakgwera	
		[2] nyakana le dibaka tša mošomo	
		[3] nyakana le dibaka tša thekgo ya mašeleng	
		[4] tsomana le tshedimošo	
		[5] dira letseno goba tshelete	
		[6] boloka setšo saka	
		[7] Thuto (inthaneteng)	
		[8] Laola nako	
		[9] Ga e nthuši	
		[10] Tše dingwe	
CT.5	Theknolotši ga e bohlokwa mo bophelong bjaka ka mabaka a latelago (Hle swaya tše mmalwa goya le ka fao o naganago ka gona).	[1] Ga e na mohola	
		[2] Di senya maphelo a batha	
		[3] E kotsi	
		[4] Ga ke tsebe go e šomiša	
		[5] Ke	
		[6] It is expensive	
		[7] Other	
CT.5	Ke didirišwa dife godimo ga tšeo di latelago tšeo o di dirišago go boloka setšo? Hle swaya.	[0] Ga gona	
		[1] Video	

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		[2] Dinepe	
		[3] Wikipedia	
		[4] Se-tšea-mantšu	
		[5] Tše dingwe	
CT.6	Ke diteng /tshedimošo efe ya setšo yeo	[1] Histori ya motse	
	elego bohlokwa go wena gore e bolokwe?	[2] Histori ya lapa (moeno le sereto)	
		[3] Mmino	
		[4] Polelo	
		[5] Melao ya motse	
		[6] Diaparo	
		[7] Dijo	
		[8] Tikologo (dibjalo/dinoka/dithaba)	
		[9] Temo	
		[10] Tše dingwe	
CT.7	Ke di-App dife godimo ga tšeo di latelago tšeo o di dirišago go lota šetšo sag ago?	[1] Lešika la lapa	
		[2] Mmino	
		[3] Dipapadi	
		[4] Diaparo	
		[5] Apea	
		[6] Makgotla a modišano	
		[7] Anega dikanegelo	
		[8] Mmepe wa go bolela	
		[9] Tšhupamabaka	
		[10] Mešomo ya boiphedišo	
		[11] Tše dingwe	
CT.8	Naa o hlama goba o tseba motho yo a hlamago 'Apps' go thekga ditiro le ditshepedišo tša setšo sa tikologo?	[1] Ee Ge karabo e le ee, ke 'App' efe yeo o e hlamilego goba yeo o e tsebago gore e hlamilwe ke motho gotšwa motseng wo?	
		[2] Aowa	
CT.9	O ithutile bjang go diriša theknolotši go mabaka ao a latelago? 1. Boloka setšo 2. Boiphedišo 3. Kgokagano ya leago 4. Mokgwa wa thenknolotši wa go romela, boloka le go diriša tšhelete ka sellathekeng (Mobile money)		
	MEDIRO YA SETŠHABA YA BOEPHEDIŠO, LETSENO LE DITSHENYAGALELO		
CEIE.1	Ke mediro-kgolo efe goba ditiro kgolo tša ekonomi tša boephedišo mo motseng wo?	[1] Bolemi	
		[2] Leruo	
		[3] Ditiroatla	
		[4] Boeti	
		[5] Kadimišo ya tšhelete (Mashonisa)	
		[6] Mogodišano	
		[7] Mochaina	
		[8] Dikarata (Gambling, Jokers cards)	
		[9] Tše dingwe	

NYAKIŠIŠO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIŠO, DITIRO LE DITSELA TŠA TSEBO YA SETŠO LE MEKGWA YA BATHO GO PHETHOGO YA TITŠITHALE: E SWANETŠI O TLATŠWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

CEIE.2	Ke dilwana dife tšeo dirišago tšhelete ya gago gantši go tšona? Hle swaya goya ka bohlokwa bja tšona (1 e bohlokwa kudu, 10 ga e bohlokwa kudu)	[1] Dijo/dihlokwa tša ka gae	
		[2] Mothelo	
		[3] Diaparo	
		[4] Phahlo	
		[5] Thuto	
		[6] Booithabišo/Mekete	
		[7] Mahu	
		[8] Dikgokagano (letša mogala, romela molaetša, data)	
		[9] Stokvel	
		[10] Tše dingwe	
CEIE.3	Malebana le ditshenyagalelo tša sellathekeng: o ka mpotša gore o dirišitše bokae go 'data' kgweding ya go feta (konteraka)? (0= Ge e le gore ga o diriši sellathekeng. Le gee le gore o patelelwa ke mongwe, ngwala tshelete yeo gomme o laetše.	Data	
		[1] R12 –R29	
		[2] R29 – R150	
		[3] R150 – R25	
		[4] R250-350	
		[5] R350 - 500	
		[6] R500 – 1500	
		[7] R1500+	
CEIE.4	Malebana le ditshenyagalelo tša sellathekeng: o ka ba o dirišitše bokae go reka 'data' kgweding ya go feta (ba go se be ka fase ga konteraka)?	[1] R12 –R29	
		[2] R29 – R150	
		[3] R150 – R25	
		[4] R250-350	
		[5] R350 - 500	
		[6] R500 – 1500	
CEIE.5	Ke dikganyogo dife tša batho tša malebana le lapa/setšhaba? Di beye goya ka tatelano ya bohlokwa bja tšona.	[1] Lephelo le le kaone	
		[2] Hwetša thuto	
		[3] Hwetša mešomo	
		[4] Oketša poelo ya dikgwebo tšaka	
		[5] Mošomo	
		[6] Eta	
		[7] Semoya	
		[8] Go hwetša bokgoni bjo boswa (Khomphutha)	
		[9] Thoma kgwebo	
		[10] Go ba le khomphutha	
		[11] Diriša inthanete	
		[12] Boloka tšhelete	
		[13] Boloka/lota setšo saka	
		[14] Botho (Ubuntu)	
		[15] Khutšo	
		[16] Hlankela bjalo ka moetapele wa setšhaba	
		[17] Tšhereletšego ya dijo	
		[18] Seboka	
		[19] Tše dingwe	
CPP.20	O nagana gore theknolotši e ka o thuša bjang go fihlelela dikganogo tša gago?	[1] Tšweletša tshedimošo	
		[2] Kgontšha kgokagano	
		[3] Dira letseno	
		[4] Oketša go kgatha tema (setšhabeng le dipolitiking)	

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		[5] Boloka le go abelana tshedimošo	
		[6] Hlama di-app	
		[7] Tše dingwe	
CPP.21	Ke eng seo o se bonago bjalo ka tšwetšopele bophelong bja gago, lapeng le setšhabeng?	[1] Diriša inthanete	
		[2] Diriša DSTV	
		[3] Go ba le tšhelete	
		[4] Goba le naga	
		[5] Tokologo ya go kgetha, tšea diphetho le go phela ntle le mapheko.	
		[6] Phela ga botse (lephelo le le kaone)	
		[7] Tše dingwe	
	KAMOGELO LE TIRIŠO YA TITŠITHALE		
DAU.1	Naa o tseba gore inthanete ke eng?	[1] Ee	
		[2]Aowa	
DAU.2	O kile wa diriša inthanete?	[1] Ee	
		[2] Aowa	
DAU.3	Ke eng se se golo seo se o thibelago go diriša inthanete?	[1] Ga go selo	
		[2] Hloka nako	
		[3] Gontura ga data	
		[4] Hlokego ya tshedimošo ka polelo yaka	
		[5] Lebelo la inthanete	
		[6] Taba ya sephiri (Privacy)	
		[7] Ke tšhaba go topa virus	
		[8] Ga ke a dumelelwa go e diriša	
		[9] E ba bothata go nna go e diriša	
		[10] Tše dingwe	
DAU.4	Ge o diriša inthanete, o fetša nako ye ntši go eng?	[1] Tabeng tša mošomo	
		[2] Tabeng tša thuto	
		[3] Kgokagano tša leago	
		[4] Ditaba	
		[5] Boithabišo [6] Tše dingwe	
DAU.5	Go ya le ka ditiro le ditshepedišo tša setšo tšeo o di tsebago le ditiro tša ka lapeng la geno. Le diriša bjang mararankodi a theknolotši bjalo ka sellathekeng le inthanete go phetegatša tshepidiso ya setšo le mediro ya ka lapeng?	[1] Tšea dinepe tša mekete ya dikoma	
		[2] Tšea dinepe tša mekete ya manyalo le dikapešo	
		[3] Tšea kgathišo ya video mahung/polokong	
		[4] Gatiša mmino wa tikologo wa setšo (Sekgapa/Dinaka)	
		[5] Anega dikanegelo	
		[6] Go hloka tshedimošo	
		[7] Laola mašeleng (stokvel/Lehola/society)	
		[8] Laola temo	
		[9] Ditirelo tša dikgokagano (letša mogala le melaetša)	

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		[10] Kgokagana/Dira sekgwera	
		[11] Tše dingwe	
DAU.6	O kile wa utswetšwa go inthanete gomme wa loba tšhelete?	[1] Ee	
		[2]Aowa	
DAU.7	E kaba tirelo ya gago ya email e kile ya hlaselwa goba ya dirišwa ntle le tumelelo ya gago?	[1]Ee	
		[2]Aowa	
DAU.8	Ge go se na inthanete: Ke lebaka lefe le legolo la go dira gore o se diriše inthanete?	[1] Ga ke tsebe gore inthanete ke eng	
		[2] Ga kena sedirišwa sa go ntumelela gotsena inthanete	
		[3] Ga kena kgahlego	
		[4] Ga e ntšhomeli	
		[5] Ga e hwetšegale lifelong le ke lego gona	
		[6] E ya tura	
		[7] Ga kena nako, ke swaragane	
		[8] Hlokego ya tshedimošo ka polelo yaka	
		[9] Ga go mokgwera waka yo a e dirišago	
		[10] Taba ya sephiri (privacy)	
		[11] Ga ke a dumelelwa go e diriša	
DAU.9	Go ya ka sedirišwa seo o se dirišago kudu; ke di-App dife tšeo o di dirišago? [0]Ga ke e diriši [1] Ee, tšatši ka tšatši [2] Beke ka beke [3] Ee, nako ye nngwe (**ngwala sebaka se o se šomišago go berekisa App kgauswi le App**)		
		[1] Dikgokagano tša leago (Facebook, WhatsApp, Instagram, Snapchat, Twitter, LinkedIn	
		[2] Di-App tša dipapadi	
		[3] Di-App tša dinamelwa	
		[4] Di-App tša kgwebo (business)	
		[5] Boithabišo	
		[6] Ditaba	
		[7] Thuto	
		[8] Di-App tša setlabelo sa go tsoma tshedimošo	
		[9] Di-App tša boemo bja leratadima	
		[10] Di-App tša go romela/amogela molaetša/lentšu	
		[11] Di-App tša go dira kgwebo (Trading)	
		[12] Di-App tša maphelo	
		[13] Taolo ya mašeleng	
		[14] Di-App tša temo	
		[15] Di-App tša marato	
		[16] Go reka inthaneteng (Online)	
		[17] Go tsoma (Google) bokgabo le setšo	
		[18] Tše dingwe	
DAU.10	Naa o amogela tshedimišo ya malebana le maphelo goba ditirelo tša maphelo go sellathekeng sa gago?	[1] Ee	
		[2]Aowa	
DAU.11	Naa e kaba o wa tseba gore mokgwa wa thenknolotši wa go romela, boloka le go diriša tšhelete ka sellathekeng (Mobile money) ke eng?	[1] Ee	
		[2] Aowa	

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DAU.12	O kile wa diriša ditirelo tša taolo ya mašeleng tša sellathekeng (mobile services), mokitlana wa tšhelete wa inthaneteng (E-wallet)?	[1] Ee	
		[2] Aowa	
DAU.13			
DAU.14	O e šomišetša mabaka afe?	[1] Go reka moya (airtime)	
		[2] Patela dikoloto	
		[3] Go amogela ditefelo	
		[4] Go amogela mogolo/phenšene	
		[5] Tše dingwe	
DAU.15	E kaba lapa le le amogela tšhelete gotšwa go maloko a lapa? Ge eba karabo ke ee, ke mokgwa ofe woo gantšintši le amogelago tšhelete ka wona?	[0] A re amogeli tšhelete gotšwa go mang goba mang	
		[1] Ka letsogo gotšwa go leloko goba mogwera	
		[2] Mootledi wa pese/ditirelo tša poso	
		[3] Ditirelo tša go romela (transfer) tšhelete	
		[4] romela (transfer) tšhelete ka tšhupaletlotlo ya panka	
		[5] Mokgwa wa thenknolotši wa go romela, boloka le go diriša tšhelete ka sellathekeng (Mobile money)	
		[6] Tše dingwe	
DAU.16	E kaba lapa la geno le a romela tšhelete go maloko a lapa? Ge karabo e le ee, ke mokgwa ofe woo le o dirišago gantšintši go romela tšhelete?	[0] A re romele motho tšhelete	
		[1] Ka letsogo goya go leloko goba mogwera	
		[2] Mootledi wa pese/ditirelo tša poso	
		[3] Ditirelo tša go romela (transfer) tšhelete	
		[4] romela (transfer) tšhelete ka tšhupaletlotlo ya panka	
		[5] Mokgwa wa thenknolotši wa go romela, boloka le go diriša tšhelete ka sellathekeng (Mobile money)	
		[6] Tše dingwe	
DAU.17	O na le akhaonte ya panka?	[0] Ga eyo mo	
		[1] Absa	
		[2] FNB	
		[3] Standard bank	
		[4] Capitec	
		[5] Nedbank	
		[6] TymeBank	
		[7] Ke diriša tšhupaletlotlo ya mongwe	
DAU.18	O romela goba o amogela tšhelete Ke ga kaakang o šomiša mogala?	[0] A ke romele goba go amogela	
		[1] Ga tee mo kgweding	
		[2] Beke ka beke	
		[3] Tšatši ka tšatši	
		[4] Go feta ga tee mo kgweding	
DAU.19	Ke tšhelete ya go lekana bo kae yeo o fela o e romela goba o e amogela go thekišetšano ye tee (one transaction)	R50- 500	
		R500 - 1000	
		R1000-2000	

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DAU.20	Mokgwa wa thenknolotši wa go romela, boloka le go diriša tšhelete ka sellathekeng (Mobile money) o bohlokwa tabeng ya go laola mašeleng.	[1] Ke a dumela	
		[2] Ke a gana	
DAU.21	Mokgwa wa thenknolotši wa go romela, boloka le go diriša tšhelete ka sellathekeng (Mobile money) o nthuša go boloka nako le ditšhenyagalelo tša senamelwa.	[1] Ke a dumela	
		[2] Ke a gana	
DAU.22	Go šomiša mokgwa wa thenknolotši wa go go romela, boloka le go diriša tšhelete ka sellathekeng (Mobile money) o kotsi kudu, thenknolotši e kano šitwa.	[1] Ke a dumela	
		[2] Ke a gana	
DAU.23	E kaba o diriša dikgokagano tša leago bjalo ka Facebook, WhatsApp, Twitter?	[1] Aowa	
		[2] Ee	
DAU.24	Ke tshedomošo ya mohuta mang yeo o e phatlalatšago go dikgokagano tša leago?	[0] Ga eyo mo	
		[1] Ditaba	
		[2] Ditiragalo	
		[3] Mmino	
		[4] Tshedimošo ya hlohleletšo	
		[5] Sedumedi	
		[6] Thuto	
		[7] Setšo	
		[8] Kgwebo	
		[9] Temo	
		[10] Tša Mašeleng	
		[11] Tše dingwe	
DAU.25	O diriša dikgokagano tša leago go mabakeng afe?	[1] Bala ditaba	
		[2] Boledišana	
		[3] Letša mogala	
		[4] Raloka dipapadi	
		[5] Go ikgokagantšha le bagwera le ba lapa.	
		[6] Go ikgokagantšha le batho tabeng ya mošomo le kgwebo	
		[7] Go rekiša ditšweletšwa le ditirelo tšaka	
		[8] Go šala morago dikgokagano tša leago tša mmušo	
		[9] Mešomo, menyetla,	
		[10] Go dira segwera	
		[11] Go šala morago bo Ra/dapolitiki ba tikologo	
		[12] Go hwetša megopolo/go abelana maitemogelo	
		[13] Go phatlalatša di video/dinepe/mmino	
		[14] Go phatlalatša diteng/tshedimošo yeo e tšweleditšwego ke nna	
		[15] Go tsomana le tshedimošo ya tša thuto	
		[16] Tše dingwe	

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DAU.26	Bolwetši bja Corona virus bo bontšha bohlokwa bja gore bana ba sekolo ba hloka inthanethe gore ba tšwele ka dithuto tša bona.	[1] Ke a gana	
		[2] Ke gana ke tiišitše	
		[3] Ke a dumela	
		[4] Ke dumela ke tiišitše	
DAU.27	Bana ba mephato ka moka ya sekolo ba swanetšwe go abelwa thuto ya go sepedišwa ke inthanethe.	[1] Ke a gana	
		[2] Ke gana ke tiišitše	
		[3] Ke a dumela	
		[4] Ke dumela ke tiišitše	
DAU.28	Go gona phapano magareng a go abela dithuto ka sepetšo ya inthanethe le ka mokgwa wo o tlwaeligo wa ka diphapušing tša thuto.	[1] Ke a gana	
		[2] Ke gana ke tiišitše	
		[3] Ke a dumela	
		[4] Ke dumela ke tiišitše	
DAU.29	Nka tšwela pele go šomiša goba ka eletša ba le leloko laka go tšwela pele go šomiša inthanethe go ithuta ge go ka direga gore setšhaba se dule ka tlase ga melao ya katologano ka lebaka la Coronavirus.	[1] Ke a gana	
		[2] Ke gana ke tiišitše	
		[3] Ke a dumela	
		[4] Ke dumela ke tiišitše	
DAU.30	Ke ekemišeditši gore nka adimišana comphuta goba sellathekeng le inthanete tšaka go thuša ba lelapa laka gore ba kgone go fihlelela dithuto tšeo di abelwago ka inthanete	[1] Ke a gana	
		[2] Ke gana ke tiišitše	
		[3] Ke a dumela	
		[4] Ke dumela ke tiišitše	
DAU.31	Ke bona e le gore bana ba dinaga ma ageng ba ikemišeditše go berekisa inthanete gore ba kgone go tšwetša dithuto tša bona pele.	[1] Ke a gana	
		[2] Ke gana ke tiišitše	
		[3] Ke a dumela	
		[4] Ke dumela ke tiišitše	
DAU.32	Ge nka hwetša monyetla nka ithuta ka mokgwa wa go diriša inthanete	[1] Nkaba hlohloletša kudu kudu	
		[2] Nkaba hlohloletša	
		[3] Ke boemagare	
		[4] Ga ke bone nka hlohloletša	
		[5] Nka se tsoge ba hlohleleditše	
DAU.33	Nka hlohleletša ba lapa laka gore ba ithute ka mokgwa wa go diriša inthanete	[1] Nkaba hlohloletša kudu kudu	
		[2] Nkaba hlohloletša	
		[3] Ke boemagare	
		[4] Ga ke bone nka hlohloletša	
		[5] Nka se tsoge ba hlohleleditše	
BOKGONI BJA TITŠITHALE, MANTLWANE LE TUKIŠETŠO YA MONAGANO			
DSMMM.1	O kile wa hwetša tlhahlo efe goba efe ya bokgoni bja titšithale?	[1] Pragrama ya khomphutha/ Go enkhouta	
		[2 Go tšweleletša diteng/tshedimošo (music, video)	
		[3] Tlanya	
		[4] Tlhama di-App	
		[5] Emails	

NYAKIŠIŠO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIŠO, DITIRO LE DITSELA TŠA TSEBO YA SETŠO LE MEKGWA YA BATHO GO PHETHOGO YA TITŠITHALE: E SWANETŠI O TLATŠWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

		[6] Go tšea dinepe le di-video	
		[7] Go berekiša inthanete	
		[8] Tše dingwe	
DSMMM.2	Setšhaba se na le mafelo a go ithuta/ mafelo a ka ntle a sekolo go ruta batho ka	[1] Setšo	
		[2] Temo	
		[3] Tšhelete	
		[4] Hlokomela bana [5] Mešomo ya ka gae	
		[6] Tše dingwe	
DSMMM.3	Diprojeke tša setšhaba bjalo ka temo di phethagatšwa ke	[1] Batho fela	
		[2] Dihlopha	
		[3] Tše dingwe	
DSMMM.4	Mongwe le mongwe yo a kgathago tema go makgotla a tšhelete bjalo ka ditlamo tša motse ba ile sekolong go ithuta ka go hlokomela diprojeke tša bona	[1] Aowa	
		[2] Ithuta ka go dira	
		[3] Ithuta ka go bona	
		[4] Tše dingwe	
DSMMM.5	Go ithuta kae bokgoni?	[1] Sekolong	
		[2] Gae	
		[3] Ithuta ka nna beng	
		[4] Go balapa le bagwera	
		[5] Seyalemoyeng	
		[6] Inthaneteng	
		[7] TV	
DSMMM.6	Go reng o be o le bohlokwa go wena gore go ithute?	[1] Go hwetša bokgoni bjo boswa	
		[2] Thoma business	
		[3] Menyetla ya mešomo	
		[4] Go no ithabiša	
		[5] Tše dingwe	
DSMMM.7	E kaba o na le se sengwe seo o ratago o se ruta go fetiša tšeo e lego gore o kgona go di dira ga bjale? Lebaka ke eng?		
DSMMM.8	Bontši bja batho mo motseng ba tšea maikarabelo a dihlokwa tša go ithuta ga bona. Ba ithuta ka go lebelela ba bangwe le go ekišetša ba bangwe.	[1] Ke a dumela	
		[2] Ke a gana	
DSMMM.9	Theknolotši e go thuša ka tsela efe go fihlelela merero ya gago ya go ithuta?	[1] Ga gona	
		[2] Lebelela di-video go ditaba tšeo ke nyakago go ithuta tšona	
		[3] Go kgathatema go thutofahlošo ya webinars	
		[4] Go theeletša/lebelela dipolelo tša hlohleletšo	
		[5] Go aga kgokagano ya kgwerano	
		[6] Go tlhatha menyetla ya go ithuta	
		[7] Tše dingwe	

NYAKIŠIŠO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIŠO, DITIRO LE DITSELA TŠA TSEBO YA SETŠO LE MEKGWA YA BATHO GO PHETHOGO YA TITŠITHALE: E SWANETŠI O TLATŠWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

DSMMM.10	Bokgoni bjo o ithutilego bjona bo o thuša ka tsela efe go fihlelela merero ya gago ya boiphedišo?	[1] Ga gona	
		[2] Dira letseno	
		[3] Go dira ditharollo tša titšithale	
		[4] Go nyakana le mošomo o moswa	
		[5] Go ruta batho ba bangwe ka menyetla ya titšithale	
		[6] Other	
INFRASTRAKTŠHA YA TITŠITHALE			
DI.1	O na le sedirišwa sa titšithale?	[1] Khomphutha/khomphutha ya go thetha	
		[2] Sellathekeng	
		[3] Sellathakeng sa seka Khomphutha (Tablet)	
		[4] Tše dingwe, hle di ngwale	
DI.2	Ge eba ona le sellathekeng, ke sa mohuta mang?	[1] Sa motheo (sepipipi) [2] Sa go sepela le mabaka a se bjale (Smart)	
DI.3	Ge e le gore ga ona sedirišwa sefe goba sefe sa titšithale, go reng go le bjalo? Mabaka ke afe?	[1] Ga gona tšhelete ya go se reka	
		[2] Mabaka a sedumedi	
		[3] Mabaka a setšo	
		[4] A ke kgone o se diriša	
		[5] Tše dingwe	
DI.4	O bala kuranta gantši gakaakang?	[0] A ke bale [1] E sego ka mehla [2] Ka beke [3] Tšatši ka tšatši	
DI.5	E kaba ka lapeng la geno le dirisa TV ya go patelwa (mohlomongwe kgwedi ka kgwedi bjalo ka DSTV)? Ge eba karabo ke ee, laetša gore ke efe?	[1] Ee [2] Aowa	
DI.6	O kile wa diriša mogala wa setšhaba kgweding tše tharo tša go feta?	[1] Ee [2] Aowa	
DI.7	O diriša khomphutha/khomphutha sebaka se se kaakang mo bophelo bja gago? (desktop or laptop)	[0] A ke di diriši	
		[1]] Iri	
		[2] Tšatši ka tšatši	
		[3] Nako ye le yela	
DI.8	O na le khomphutha goba khomphutha ya go thetha?	[1] Ee	
		[2] Aowa	
DI.9	Goya le ka sedirišwa seo o nago le sona, ke sedirišwa sefe seo o se dirišago kudu le gona lebaka ke lefe?		
DI.10	E kaba gona le lefelo la setšhaba moo go dirišwago dikhomphutha/ Goba lefelo la inthanete motseng wa geno?	[1] Ee	
		[2] Aowa	
DI.11	Ge eba le gona, o le diriša gakaakang?	[0] Ga ke le diriše	
		[1] Ga tee ka iri goba gafetšagafetša	
		[2] Ga tee ka kgwedi	
		[3] Mo go sa fetego ga tee ka kgwedi	
DI.12	Ge o sa le diriše , mabaka a gago ke afe?		
DI.13	E kaba lapa la geno le na le dilo tšeo di latelago tšeo di šomago? Hle swaya	[1] Seyalemoya	
		[2] TV	
		[3] Khomphutha	
		[4] Khomphutha ya go thetha	
		[5] DSTV	
		[6] Sellathekeng sa seka khomphutha (Tablet/IPAD)	

NYAKIŠIŠO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIŠO, DITIRO LE DITSELA TŠA TSEBO YA SETŠO LE MEKGWA YA BATHO GO PHETHOGO YA TITŠITHALE: E SWANETŠI O TLATŠWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

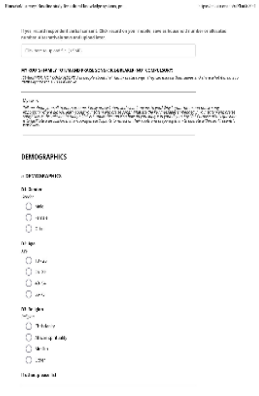
DI.14	E kaba lapa la geno le na le kgokagano ya inthanete yeo e šomago? Ge eba ee, laetša gore o e diriša bjang?	[1] Dillathekeng	[1] Ee [2] Aowa	
		[2] Wi-Fi	[1] Ee [2] Aowa	
		[3] USB dongle mifi	[1] Ee [2] Aowa	
		[4] ADSL	[1] Ee [2] Aowa	
		[5] Fibre	[1] Ee [2] Aowa	
		[6] Tše dingwe	[1] Ee [2] Aowa	
DI.15	Ke maloko a ma kae a lapa ao a dirišago inthanete?	[0] Ga gona		
		[1] Ka moka		
DI.15	Goya ka mešomo ya inthanete hle laetša gore ye bohlokwa ke efe? (1= e bohlokwa kudu, 8= ga e bohlokwa kudu)	[1] Thuto		
		[2] Reka		
		[3] Kgokagano ya kgwerano		
		[4] Taba tša mošomo		
		[5] Ditirelo tša mmušo		
		[6] Tsomana le mošomo		
		[7] Go banka inthaneteng (online)		
		[8] Tše dingwe, di laetše		
DI.16	Ke lebaka la mengwaga ye me kae o ntši o diriša inthanete?	[1] Tekano ya ka fase a ngwaga		
		[2] Go feta ngwaga		
DI.17	Ge e le gore o diriša Wi-Fi o e diriša gotšwa kae?	[1] Ka gae		
		[2] Lefelong la Setšhaba		
		[3] Sekolong		
		[4] Go sedirišwa saka (sellathekeng/tablet)		
		[5] Tše dingwe		
DI.18	La mathomo o diritše inthanete go sellathekeng goba khomphutha?	[1] Khomphutha		
		[2] Sellathekeng		
		[3] Tablet		
DI.19	Ke gantši gakaakang mo o dirišago inthanete ka sellathekeng	[0] Ga ke e diriši		
		[1] Ga tee ka iri goba gafetšagatša		
		[2] Gaa tee ka kgwedi		
		[3] Mo go sa fetego ga tee ka kgwedi		
DI.20	Ke gantši gakaakang mo o dirišago inthanete ka khomphutha	[0] Ga ke e diriši		
		[1] Ga tee ka iri goba gafetšagatša		
		[2] Gaa tee ka kgwedi		
		[3] Mo go sa fetego ga tee ka kgwedi		
DI.21	Ke gantši gakaakang mo o dirišago inthanete ka Wi-Fi ya setšhaba?	[0] Ga ke e diriši		
		[1] Ga tee ka iri goba gafetšagatša		
		[2] Gaa tee ka kgwedi		
BOETAPELE BJA DITŠITHALE				
DL.1	Ke mang yo a rwetšego maikarabelo a go tliša tharollo ya titšithale setšhabeng sa geno?	[1] Kantoro ya Mošate		
		[2] Sekolo		
		[3] Kereke		
		[4] Mekgahlo yeo e sego ya mmušo		
		[5] Kgwebo		
		[6] Mmušo		
		[7] Tše dingwe		
DL.2	Ke tema efe yeo o e kgathago go netefatša gore setšhaba sa geno e ba setho sa boiphedišo bja titšithale?	[1] Ga gona		

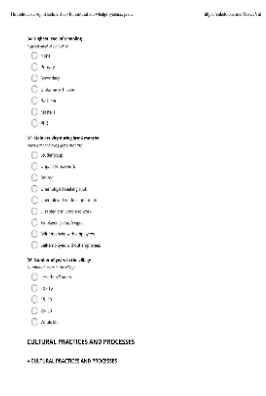
NYAKIŠIŠO YA KA LAPENG: MOLAMOTHALOTHEO WA TSHEPEDIŠO, DITIRO LE DITSELA TŠA TSEBO YA SETŠO LE MEKGWA YA BATHO GO PHETHOGO YA TITŠITHALE: E SWANETŠI O TLATŠWA KE BATHO BAO BA NO KGETHILWEGO FELA BA NAGO LE MENGWAGA YE 18 LE GO FETA.

	Swaya mapokisi a mmalwa ao a lego maleba go wena.	[2] Tšweletša diteng/tshedimošo ya tikologo	
		[3] Tšweletša di-App tša tikologo	
		[4] Ngwala ditiro le ditshepedišo tša setšo	
		[5] Abelana setšo s arena le lefase	
		[6] Dira nyakišišo ka phetogo ya titšithale	
		[7] Tše dingwe	
DL.3	Ke tema efe yeo o nagana gore mmušo o ka e kgathata go thuša setšhaba gore se kgone go tšea karolo go ekonomi ya go phethakgatšhwa ke inthanethe? Swaya mapokisi a mmalwa ao a lego maleba go wena.	[1] Ga gona	
		[2] Go aba dithuto	
		[3] Go abelana ka ditšhelete	
		[4] Go thoma diprojeke	
		[5] Go khetha baetapele ba thekinolotši	
		[6] Tše dingwe	
DL.4	Ge setšhaba se ka netefatša go hlongwa ga lefelo la go ithuta ka tšhithithale tikolong, o ka rata go dira eng go ithuteng? Swaya dikarabo ka bontši.	[1] Go ithuta go šomiša khomputha	
		[2] Sekgoba sa go printha	
		[3] Sekgoba sa go šomiša email	
		[4] Sekgoba sa go šomiša inthanethe bjalo ka Skype	
		[5 Di direšwa go kgokagana le badiriši ba bangwe ba inthanethe go tšwa mafelong a go fapana gore re hwetše tsebo	
		[6] Dira nyakišišo ka phetogo ya titšithale	
		[7] Sekgoba sa go tšweletša di –App go thuša setšhaba	
		[7] Sekgoba sa go ithuta go šomiša di-Apps	
		[8] o ba le go ithuta tša thuto ka inthanethe (online learning)	
		[9] Go tšweletša tša kgwebo	
		[10] Go tšweletša dipapadi tša inthanethe	
DL.5	Ge setšhaba se ka thoma ka taba ya go hlola lefelo la go ithuta titšithale, o nagana gore batho ba tlo rata go tsentšha letsogo ka mekgwana ya go kgoboketša tšhelete ka tsela ya go boloka goba neela tšhelete ka seboka?	[1] Ke a dumela	
		[2] Ke a gana	

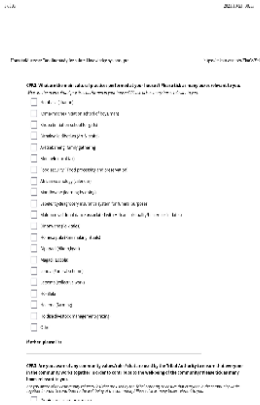
Appendix J: Digital household survey https://enketo.ona.io/x/ZkaOvYnI

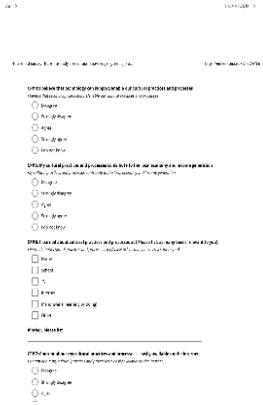

Household survey: Baseline study for cultural knowledge systems, practices and processes as well as individual digital transformation patterns in Mamaila Tribal Authority: To be completed by randomly selected individuals 18 years and older

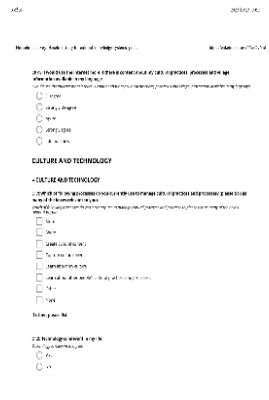

DEMOGRAPHICS


CULTURAL PRACTICES AND PROCESSES



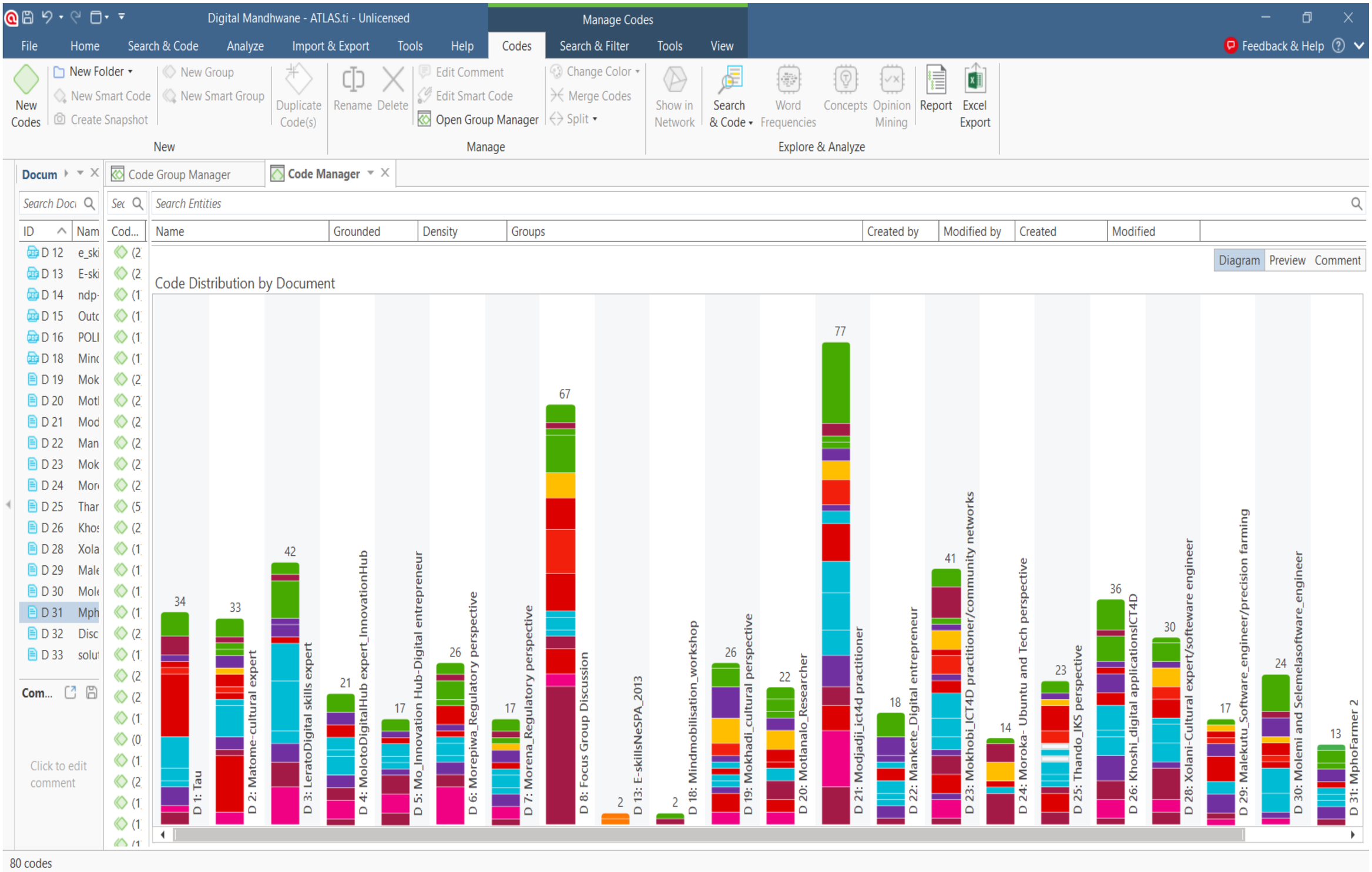




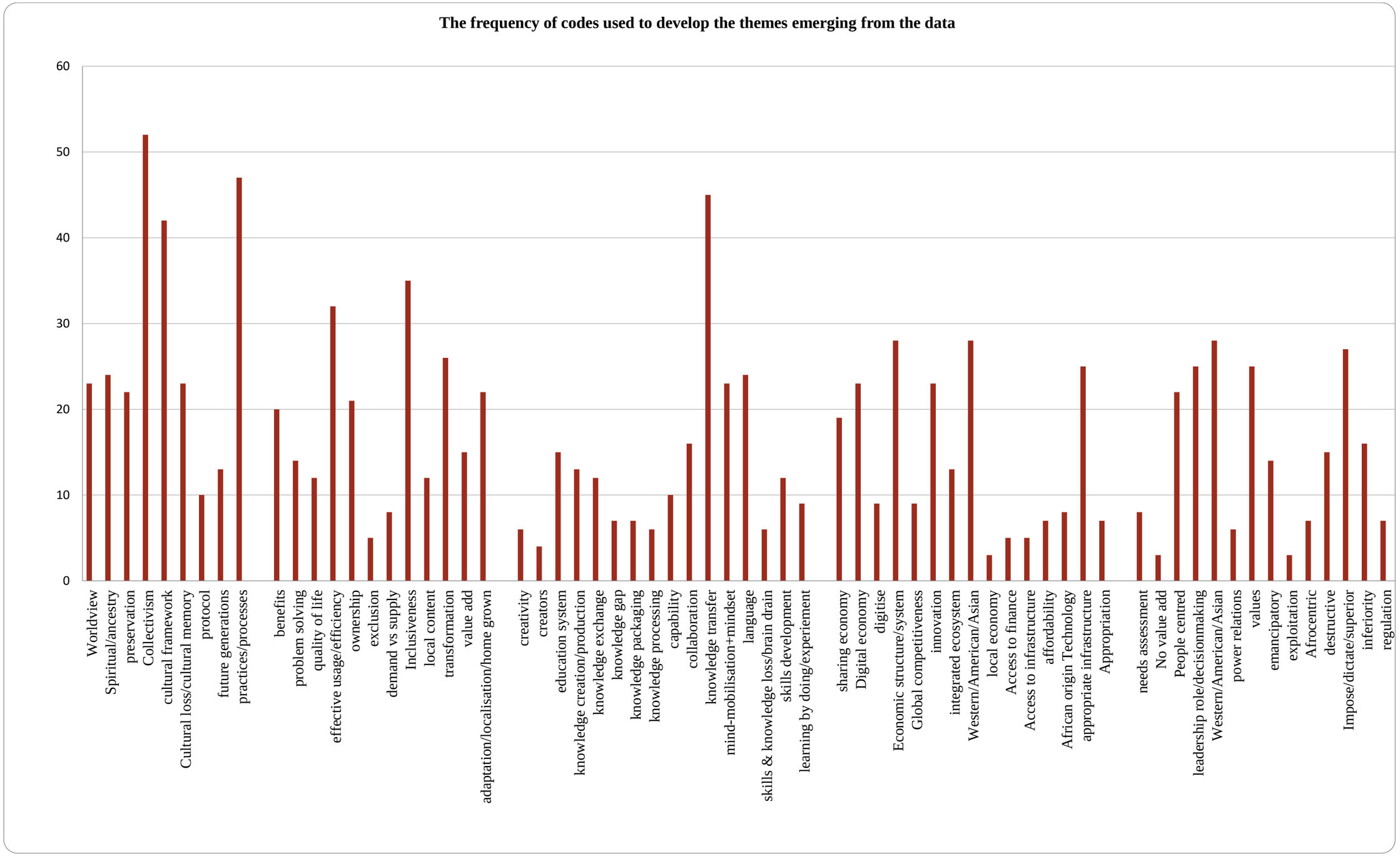

CULTURE AND TECHNOLOGY



Appendix K: Example of the frequency of codes per respondent



Appendix L: The frequency of codes used to develop the themes emerging from the data



Appendix M: Ethical clearance certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Magoro

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H20/02/50**
PROJECT TITLE	Investigating cultural knowledge systems, Mandhwane and mind mobilisation for rural communities in the digital era
INVESTIGATOR(S)	Ms K Magoro
SCHOOL/DEPARTMENT	School of Literature, Language and Media/
DATE CONSIDERED	14 February 2020
DECISION OF THE COMMITTEE	Approved Risk Level: Low
EXPIRY DATE	19 April 2023

DATE 20 April 2020 **CHAIRPERSON** _____ (Professor J Knight)

cc: Supervisor : Dr L Abrahams

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature **Date** 20/07/2020

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix N: Research permission granted by Mamaila Tribal Council



TRADITIONAL COUNCIL

"BALOBEDU BA-BIMA KOLOBE"

DEPARTMENT OF CO-ORPERATIVE GOVERNANCE, HUMAN SETTLEMENTS & TRADITIONAL AFFAIRS.

LIMPOPO PROVINCIAL GOVERNMENT

Ref: CH 11/8/4-70
Enq: Mokgola M.O
Office: +2771 659 9576

P.O.Box 493
PAULUSWEG
0814
Dated: 06/01/2020

Attention: Kgopotso Ditshego Magoro

Student Number: 586570

APPROVAL TO CONDUCT RESEARCH WITHIN MAMAILA TRIBAL AUTHORITY

1. We hereby confirm that Mamaila Tribal Authority approves that you collect data for your academic research titled: **Investigating cultural knowledge systems, Mandhwane and Mind Mobilisation for rural digital communities.** The research is conducted within the scope of Mamaila Community Network, a Wi-Fi project that aims to connect villages within the jurisdiction of Mamaila Tribal Authority, implemented by the Zuri Foundation.
2. We hope that your research findings, in particular the household survey on technology usage patterns and cultural knowledge systems will be shared with the Tribal Authority and be used for the benefit of the community as a whole.
3. We further wish to express that we reserve the right to withdraw our approval for this academic work should we feel that your research is contravening our communal value systems and causing conflict within the community.
4. We wish you all the best of luck in your studies. Do not hesitate to contact us if you require assistance with the identification of key research informants for your study.

Hoping and trusting that you will find this matter in a good order.

Yours in Community Service and Development

Accounting Clerk

Kgoši Mamaila K.S

OFFICE DATE STAMP

MAMAILA-KOLOBETONA
TRADITIONAL COUNCIL
06 JAN 2020
P/BAG 1324 SOEKMEKAAR
0110
MOPANI DISTRICT SUPPORT CENTRE

Appendix O: Example of participant information sheet



Morena/Mohumagadi yo a rategago

Ke nna **Kgopotso Ditshego Magoro** ebile ke moithuti wa PhD ka dithutong tša malebana le tsebo ya boiphedišo bja ditšithale (**interdisciplinary digital knowledge economy studies)** Yunibesithing ya Witwatersrand ka Johannesburg. Bjalo ka seripaa sa dithuto tšaka, ke swanetši go phetha projeke ya nyakišišo, ebile ke nyakišiša ka ditshepedišo tša tsebo ya setšo, mantlwane le tukišetšo ya monagano go ditšhaba magae tša mararankodi a theknolotši (titšithale). Morero wa projeke ye ya nyakišišo ke go hlohlomiša gore ditshepedišo tša tsebo ya setšo di ka sepediša bjang go kgatha tema ka mahlahla ga ditšhaba magae tša Afrika ka gare ga tswalano ya phetogo ya titšithale.

O ka se hwetše selo ka go kgatha tema ka gare ga nyakišišo ye, ebile ga gona ditlamorago goba kotlo ge o sa kgathe tema. O ka no lesa go kgatha tema ka nako yengwe le yengwe goba go se arabe potšišo yengwe le yengwe ge o sa rate go e araba. Nyakišišo ye e tloba ya khupamarama ya hlokaina ka ge ke tloba ke sa botšiši leina la gago goba tshedimošo efe goba efe yeo e go tlhathago, ebile tshedimošo yeo o mphago yona e tlo bolokwa ebile ya se botšwe motho yo mongwe. Ke tla diriša leina la go se be la nnete go laetša go kgatha tema a gago ka gare a pego ya mafelelo ya nyakišišo. Ge o ikwa o sa lokologa ka gare ga tshepedišo ye, re tlo emiša ka nyakišišo goba ra tšwelapele nakong yengwe.

Ge ona le potšišo pele goba ka morago malebana le nyakišišo ye, o amogetšwe go ikopantšha le nna go dikgokagano tšeo di laeditšwe kua fase. Tlhotlhomišo ye e tlo ngwalwa bjalo ka pego ya nyakišišo yeoe tlo hwetšagala inthaneteng go wepesaeteng ya bokgobapuku bja Yunibesithi. Ge o rata go amogela kararetšo ya projeke ye, nka thabela go o romela yona. Ge o na le ngongorego goba boepelaetšo malebana le boitshwaro bja tshepedišo ya nyakišišo ye, o amogetšwe go ikopantšha le Komiti ya Yunibesithi ya tša boitshwaro bja maleba malebana le nyakišišo (University Human Research Ethics Committee), mo nomorong ye ya mogala +27(0) 11 717 1408, email Shaun.Schoeman@wits.ac.za

Wa lena wa potego,
Kgopotso Ditshego Magoro
mogala: 065 996 2738|email: kdmagoro@gmail.com

Molaodi wa Nyakišišo: Dr Luci Abrahams
mogala: [illegible]gmail.com

Appendix P: Household survey PIS, consent form and example of the online consent stored on Ona.io

PIS: NYAKIŠIŠO YA KA LAPENG



Morena/Mohumagadi yo a rategago

Ke nna **Kgopotso Ditshego Magoro** ebile ke moithuti wa PhD ka dithutong tša malebana le tsebo ya boiphedišo bja ditšithale (**interdisciplinary digital knowledge economy studies)** Yunibesithing ya Witwatersrand ka Johannesburg.Bjalo ka seripaa sa dithuto tšaka, ke swanetši go phetha projeke ya nyakišišo, ebile ke nyakišiša ka ditshepedišo tša tsebo ya setšo, mantlwane le tukišetšo ya monagano go ditšhaba magae tša mararankodi a theknolotši (titšithale). Morero wa projeke ye ya nyakišišo ke go hlohlomiša gore ditshepedišo tša tsebo ya setšo di ka sepediša bjang go kgatha tema ka mahlahla ga ditšhaba magae tša Afrika ka gare ga tswalano ya phetogo ya titšithale.

Bjalo ka seripa sa projeke ye, ke tla rata go o mema go kgathatema ka gare ga nyakišišo yeo e phethwago ga tee fela. Nyakišišo ye e tlo tšea metsotso ya go obelelela ye masomethatro go e fetša. Modiro wo o tlo akaretša taba ya go araba dipotšišo ka:

- Setšo, ditiragalo (madirelo) le ditshepedišo tša ka lapeng;
- Kgokagano ya leago, mosepelo wa tshedimošo, ditiro tsa kgokagano;
- Setšo le theknolotši;
- Mešomo ya boiphedišo ya setšhaba, letseno le ditshenyagalelo;
- Kamogelo le tirišo ya titšithale;
- Bokgoni bja titšithale, Mantlwane le tukišetšo ya monagano;
- Boetapele le mananegokgoparara a titšithale.

O ka se hwetše selo ka go kgatha tema ka gare ga nyakišišo ye, ebile ga gona ditlamorago goba kotlo ge o sa kgathe tema. O ka no lesa go kgatha tema ka nako yengwe le yengwe goba go se arabe potšišo yengwe le yengwe ge o sa rate go e araba. Nyakišišo ye e tloba ya khupamarama ya hlokaina ka ge ke tloba ke sa botšiši leina la gago goba tshedimošo efe goba efe yeo e go tlhathago, ebile tshedimošo yeo o mphago yona e tlo bolokwa ebile ya se botšwe motho yo mongwe. Ke tla diriša leina la go se be la nnete go laetša go kgatha tema a gago ka gare a pego ya mafelelo ya nyakišišo. Ge o ikwa o sa lokologa ka gare ga tshepedišo ye, re tlo emiša ka nyakišišo goba ra tšwelapele nakong yengwe.

Ge ona le potšišo pele goba ka morago malebana le nyakišišo ye, o amogetšwe go ikopantšha le nna go dikgokagano tšeo di laeditšwe kua fase. Tlhotlhomišo ye e tlo ngwalwa bjalo ka pego ya nyakišišo yeoe tlo hwetšagala inthaneteng go wepesaeteng ya bokgobapuku bja Yunibesithi. Ge o rata go amogela kararetšo ya projeke ye, nka thabela go o romela yona. Ge o na le ngongorego goba boepelaetšo malebana le boitshwaro bja tshepedišo ya nyakišišo ye, o amogetšwe go ikopantšha le Komiti ya Yunibesithi ya tša boitshwaro bja maleba malebana le nyakišišo (University Human Research Ethics Committee), mo nomorong ye ya mogala +27(0) 11 717 1408, email Shaun.Schoeman@wits.ac.za

Wa lena wa potego,
Kgopotso Ditshego Magoro
mogala: 065 996 2738|email: kdmagoro@gmail.com

Molaodi wa Nyakišišo: Dr Luci Abrahams
mogala:

Appendix Q: Household survey consent form

CONSENT FORM: HOUSEHOLD SURVEY

LINK centre — Learning Information Networking Knowledge — Faculty of Humanities, University of the Witwatersrand

Title of project: investigating cultural knowledge systems, Mandhwane and Mind Mobilisation for rural communities in the digital era

Name of researcher: Kgopotso Ditshego Magoro

I, ..., agree to participate in this research project. The research has been explained to me and I understand what my participation will involve answering survey questions lasting around 30 minutes to complete. The survey involves answering questions about my

- Household cultural practices, processes;
- Social networks, information flows and network practices;
- Culture and technology;
- Community economic activities, income and expenditure income;
- Digital adoption and usage;
- Digital skills, Mandhwane and Mind Mobilisation
- Digital infrastructure and leadership

Please circle the relevant options below.

I agree that my participation will remain anonymous YES NO

I agree that the researcher may use anonymous quotes in his / her research report YES NO

..... (signature)
..... (name of participant)
..... (date)

Overview | Map | Table | Photos | Charts | Dashboard | Settings — 51 Records

Search — Show: Labels

ID integer	NAME OF THE VILL text	VILLAGE SECTION text	HOUSEHOLD NUMI integer	GPS COORDINATES geopoint	Verbal Consent to select one	If yes, record respo audio	MY ROOTS (FAMILY text	D1: Gender select one	D2: Age select one	D3: Religion select one
88432...	Roerfontein Vill...	Sandton	46	-23.359526 30....	Yes	Number 46-2...	null	Female	25- 39	Christianity
88431...	Roerfontein Vill...	Sandton	73	-23.381601 30.1...	Yes	Stand Numbe...	Moshabi	Female	18 - 25	Christianity
88430...	Roerfontein Vill...	Sandton	57	-23.381601 30.1...	Yes	Stand Numbe...	Mohale	Male	25- 39	Christianity
88430...	Roerfontein Vill...	Sandton	221	-23.381601 30.1...	Yes	Stand Numbe...	null	Female	25- 39	Christianity
88430...	Roerfontein Vill...	Sandton	120	-23.381601 30.1...	Yes	Stand numbe...	null	Female	25- 39	Christianity
87860...	Roerfontein Vill...	Meretjeni	202	-23.377417 30.1...	Yes	Stand numbe...	null	Female	25- 39	Christianity
83551...	Roerfontein Vill...	Meretjeni	94	-23.381845 30.1...	Yes	94-9_48_41.m...	null	Female	18 - 25	Christianity
83522...	Roerfontein	Meretjeni	214	-23.376885 30....	Yes	Stand 214-18...	Mphalaborwa	Male	25- 39	Christianity
83520...	Roerfontein Vill...	Meretjeni	78	-23.377416 30.1...	Yes	House 78-17_...	null	Female	18 - 25	Christianity
83514...	Roerfontein villa...	Meretjeni	54	-23.377416 30.1...	Yes	House 54-16_...	Motswetla	Female	25- 39	Christianity
83514...	Roerfontein Vill...	Meretjeni	85	-23.42308 30.1...	Yes	House 85-16_...	null	Female	25- 39	Christianity
812419...	Roerfontein	Meretjeni	322	-23.381845 30.1...	Yes	House numbe...	null	Female	25- 39	Christianity

Appendix R: Community consent form

FOROMO YA TUMELELO: MANTLWANE



Sehlogo sa projeke: Go nyakišiša tshepedišo ya tsebo ya setšo, mantlwane le tukišetšo ya monagano malebana le ditšhaba magae tša mararankodi a theknolotši (titšithale)

Leina la monyakišiši: Kgopotso Ditshego Magoro

Nna, ……., ke dumela go kgatha tema ka gare ga nyakišišo ye. Ke hlalošeditšwe ka tlhohlomišo ye ebile ke a kwešiša gore go kgatha tema aka gora go reng. Hle dira sediko o kgetho ya maleba go tšeo di latelago.

Ke a dumela gore ke tla kgatha tema bjalo ka hlokaina EE AOWA

Ke a dumela gore monyakišiši a ka no diriša ditsopolwa tšaka bjalo ka hlokaina ka gare a pego ya gagwe ya nyakisišo. EE AOWA

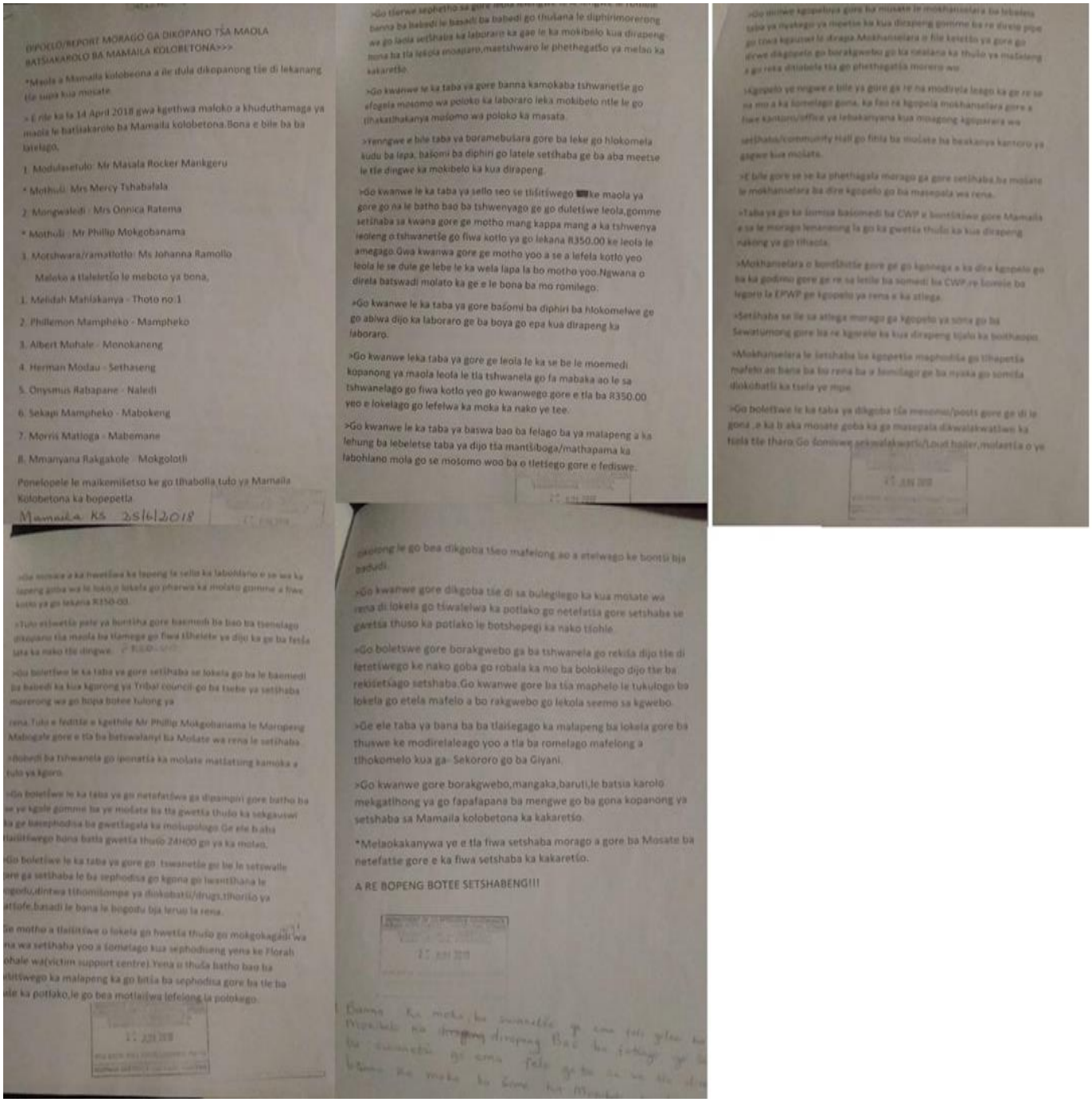
Ke a dumela gore monyakišiši a ka ntšea dinepe (gomme a fihla sefahlego saka ge dinepe tšaka di dirišwa). EE AOWA

Ke dumela o kgatha tema go tshepedišo ya mantlwane yeo e akaretšago leano la tlhamo-mmogo le tšwetšopele ya tharollo ya titšitale (mararankodia theknolotši) ka mokgwa wa go ithuta ka go dira.
EE AOWA

Ke dumela go lekolwa nakong ya leano la tlhamo-mmogo le tshepedišo ya tšweletšopele ya tharollo ya titšitale (mararankodi a theknolotši). EE AOWA

…… (mosaeno)
…… (leina la mokgathatema)
…… (letšatšikgwedi)

Appendix S: Copy of the constitution for Maola in the MTA



DIPOELO/REPORT MORAGO GA DIKOPANO TŠA MAOLA BATŠIAKAROLO BA MAMAILA KOLOBETONA>>>

*Maola a Mamaila kolobeona a ile dula dikopanong tše di lekanang tše supa kua mosate.

>E rile ka la 14 April 2018 gwa kgethwa maloko a khuduthamaga ya maola le batšiakarolo ba Mamaila kolobetona.Bona e bile ba ba latelago.

1. Modulasetulo: Mr Masala Rocker Mankgeru
* Mothuši: Mrs Mercy Tshabalala
2. Mongwaledi : Mrs Onnica Ratema
* Mothuši : Mr Phillip Mokgobanama
3. Motshwara/ramatlotlo: Ms Johanna Ramollo

Maloko a tlaleletšo le meboto ya bona,

1. Melidah Mahlakanya - Thoto no:1
2. Phillemon Mampheko - Mampheko
3. Albert Mohale - Monokaneng
4. Herman Modau - Sethaseng
5. Onysmus Rabapane - Naledi
6. Sekapi Mampheko - Mabokeng
7. Morris Matloga - Mabemane
8. Mmanyana Rakgakole - Mokgolotli

Ponelopele le maikemišetso ke go tlhabolla tulo ya Mamaila Kolobetona ka bopepetla

Mamaila KS 25/6/2018

>Go tlerwe sephetho sa gore [illegible] banna ba babedi le basadi ba babedi go thušana le diphirimorerong wa go laola setšhaba ka laboraro ka gae le ka mokibelo kua dirapeng bona ba tla lekola moaparo,maetshwaro le phethegatšo ya melao ka kakaretšo.

>Go kwanwe le ka taba ya gore banna kamokaba tshwanetše go efogela mosomo wa poloko ka laboraro leka mokibelo ntle le go tlhakaslhakanya mošomo wa poloko ka masata.

>Yenngwe e bile taba ya boramebušara gore ba leke go hlokomela kudu ba lapa, bašomi ba diphiri go latele setšhaba ge ba aba meetse le tše dingwe ka mokibelo ka kua dirapeng.

>Go kwanwe le ka taba ya sello seo se tlišitšwego [redacted]ke maola ya gore go na le batho bao ba tshwenyago ge go duletšwe leola,gomme setšhaba sa kwana gore ge motho mang kappa mang a ka tshwenya leoleng o tshwanetše go fiwa kotlo ya go lekana R350.00 ke leola le amegago.Gwa kwanwa gore ge motho yoo a se a lefela kotlo yeo leola le se dule ge lebe le ka wela lapa la bo motho yoo.Ngwana o direla batswadi molato ka ge e le bona ba mo romilego.

>Go kwanwe le ka taba ya gore bašomi ba diphiri ba hlokomelwe ge go abiwa dijo ka laboraro ge ba boya go epa kua dirapeng ka laboraro.

>Go kwanwe leka taba ya gore ge leola le ka se be le moemedi kopanong ya maola leola le tla tshwanela go fa mabaka ao le sa tshwanelago go fiwa kotlo yeo go kwanwego gore e tla ba R350.00 yeo e lokelago go lefelwa ka moka ka nako ye tee.

>Go kwanwe le ka taba ya baswa bao ba felago ba ya matapeng a ka lehung ba lebeletse taba ya dijo tša mantšiboga/mathapama ka labohlano mola go se mošomo woo ba o tlešego gore e fediswe.

>Go tlerwe sephetho sa gore [illegible] banna ba babedi le basadi ba babedi go thušana le diphirimorerong wa go laola setšhaba ka laboraro ka gae le ka mokibelo kua dirapeng bona ba tla lekola moaparo,maetshwaro le phethegatšo ya melao ka kakaretšo.

>Go kwanwe le ka taba ya gore banna kamokaba tshwanetše go efogela mosomo wa poloko ka laboraro leka mokibelo ntle le go tlhakaslhakanya mošomo wa poloko ka masata.

>Yenngwe e bile taba ya boramebušara gore ba leke go hlokomela kudu ba lapa, bašomi ba diphiri go latele setšhaba ge ba aba meetse le tše dingwe ka mokibelo ka kua dirapeng.

>Go kwanwe le ka taba ya sello seo se tlišitšwego [redacted]ke maola ya gore go na le batho bao ba tshwenyago ge go duletšwe leola,gomme setšhaba sa kwana gore ge motho mang kappa mang a ka tshwenya leoleng o tshwanetše go fiwa kotlo ya go lekana R350.00 ke leola le amegago.Gwa kwanwa gore ge motho yoo a se a lefela kotlo yeo leola le se dule ge lebe le ka wela lapa la bo motho yoo.Ngwana o direla batswadi molato ka ge e le bona ba mo romilego.

>Go kwanwe le ka taba ya gore bašomi ba diphiri ba hlokomelwe ge go abiwa dijo ka laboraro ge ba boya go epa kua dirapeng ka laboraro.

>Go kwanwe leka taba ya gore ge leola le ka se be le moemedi kopanong ya maola leola le tla tshwanela go fa mabaka ao le sa tshwanelago go fiwa kotlo yeo go kwanwego gore e tla ba R350.00 yeo e lokelago go lefelwa ka moka ka nako ye tee.

>Go kwanwe le ka taba ya baswa bao ba felago ba ya matapeng a ka lehung ba lebeletse taba ya dijo tša mantšiboga/mathapama ka labohlano mola go se mošomo woo ba o tlešego gore e fediswe.

>Go kwanwe gore dikgoba tše di sa bulegilego ka kua mošate wa rena di lokela go tšwalelwa ka potlako go netefatša gore setshaba se gawtša thuso ka potlako le botshepegi ka nako tšohle.

>Go boletswe gore borakgwebo ga ba tshwanela go rekiša dijo tše di fetetšwego ke nako goba go robala ka mo ba bolokilego dijo tše ba rekiletšago setshaba.Go kwanwe gore ba tša maphelo le tukulogo ba lokela go etela mafelo a bo rakgwebo go lekola seemo sa kgwebo.

>Ge ele taba ya bana ba ba tlaišegago ka matapeng ba lokela gore ba thuswe ke modirelaleago yoo a tla ba romelago mafelong a tlhokomelo kua ga- Sekororo go ba Giyani.

>Go kwanwe gore borakgwebo,mangaka,baruti,le batsia karolo mekgatlhong ya go fapafapana ba mengwe go ba gona kopanong ya setshaba sa Mamaila kolobetona ka kakaretšo.

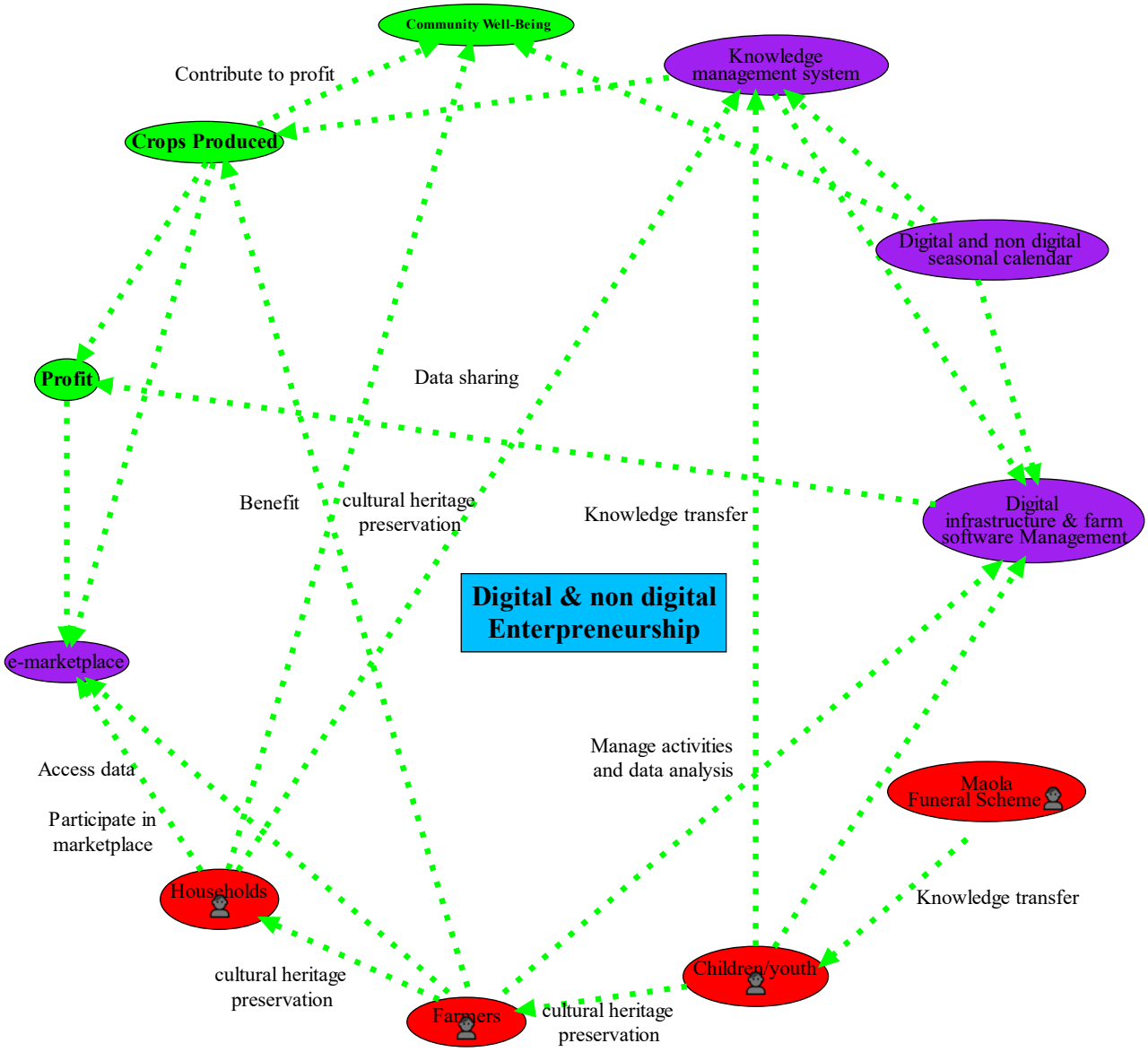
*Melaokakanywa ye e tla fiwa setshaba morago a gore ba Mosate ba netefatše gore e ka fiwa setshaba ka kakaretšo.

A RE BOPENG BOTEE SETSHABENG!!!

>Ge motho a tlaišitšwe o lokela go hwetša thuso go mokgokagadi wa na wa setshaba yoo a tomelago kua sephodiseng yena ke Florah ohale wa(victim support centre).Yena o thuša batho bao ba išitšwego ka malapeng ka go bitša ba sephodisa gore ba tle ba ale ka potlako,le go bea motlaiwa lefelong la polokego.

.

Appendix T: The potential digital local economy value chain in MTA



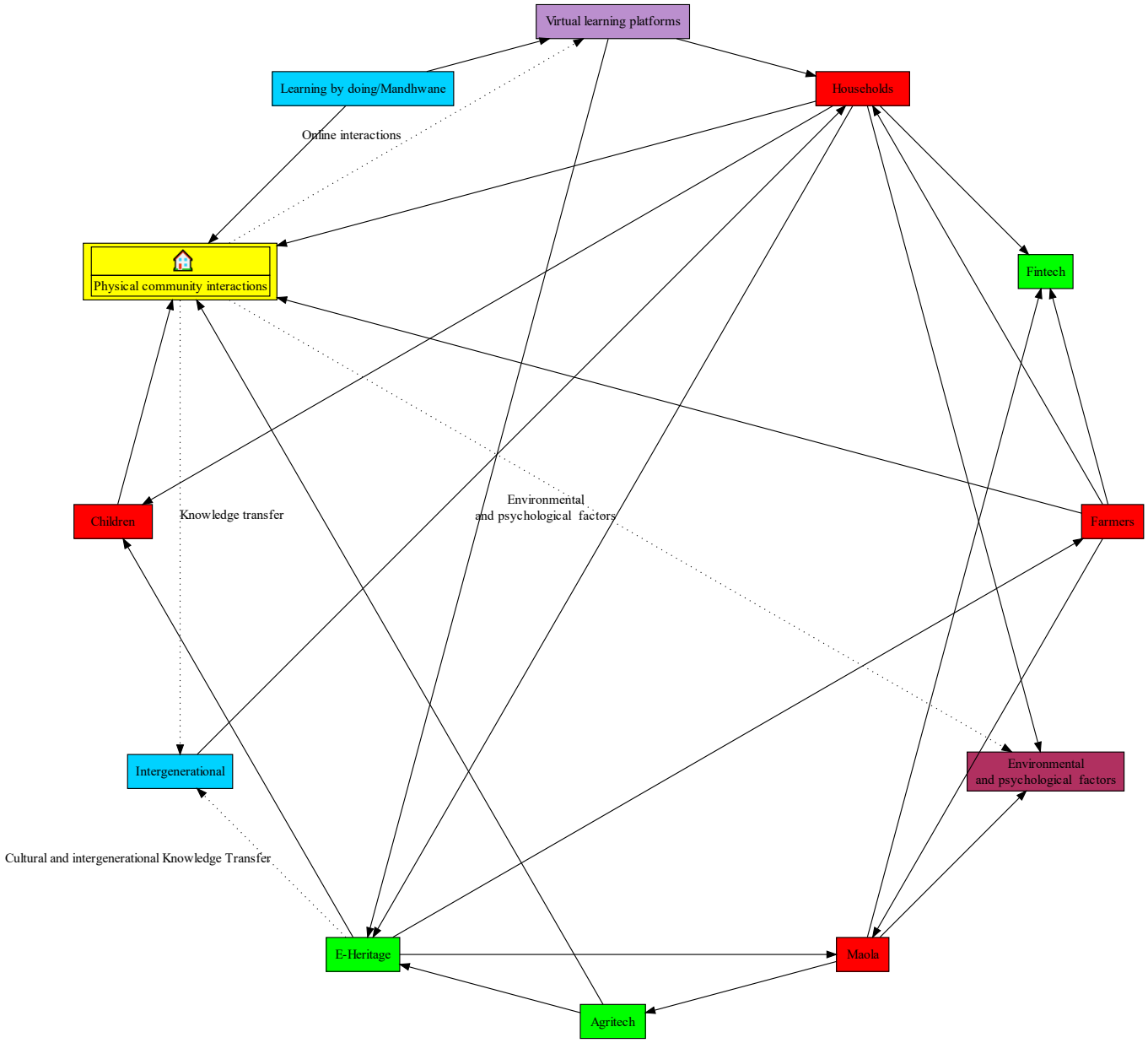
Note: The figure illustrates the potential for the development of a local digital knowledge economy as discussed in the agri-tech, fintech, and e-heritage case studies. The figure suggests that the MTA community could harness their collective capabilities and big data to foster innovation, enhance their agricultural practices, and stimulate economic growth. Source: Author, 2024.

Appendix U: Translation of the being, knowing, doing, and leading to the digital and learning economy



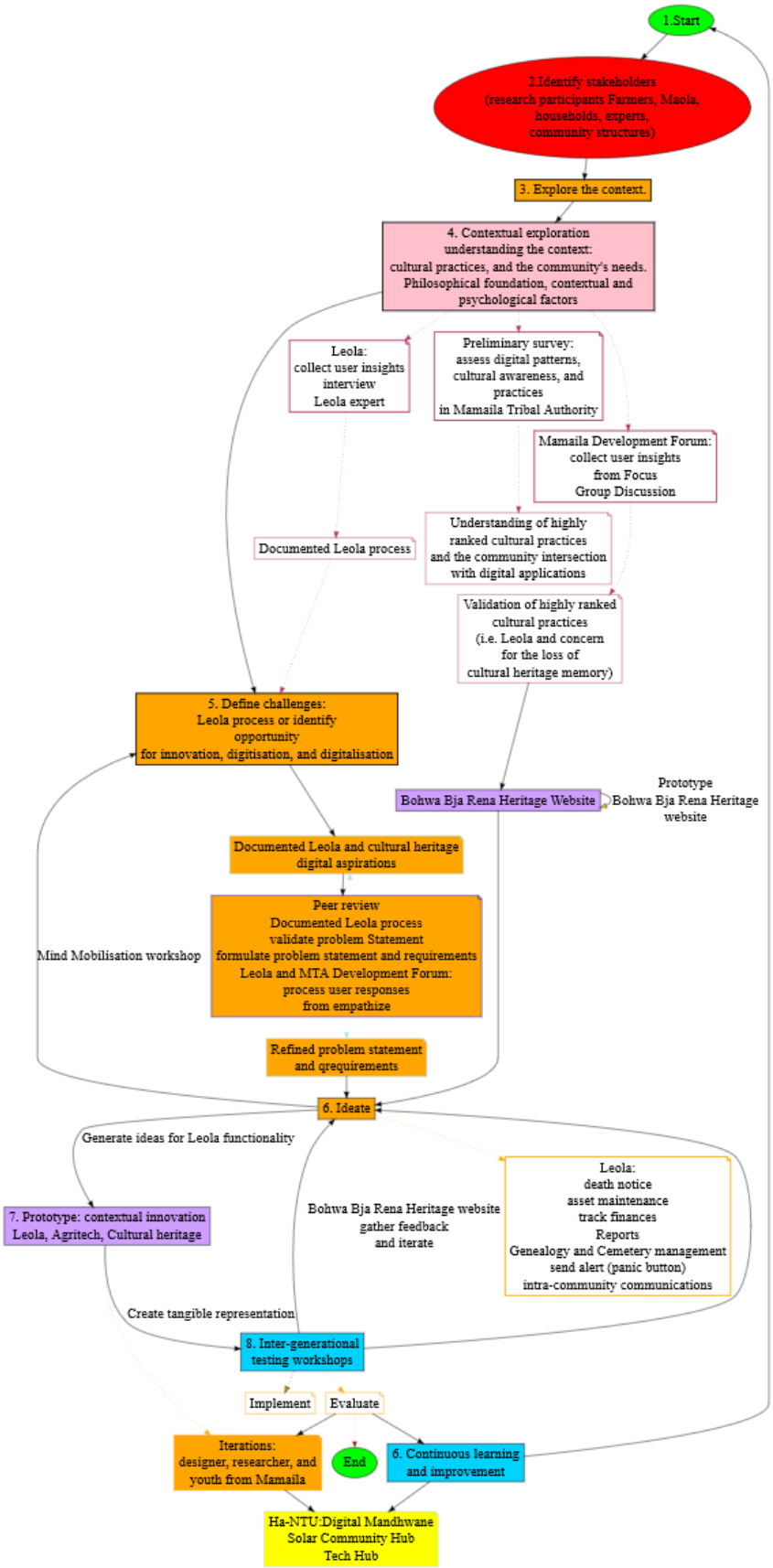
Note: This Figure illustrates the manifestation of the Imagined village and the aspirations of the Digital Mandhwane practice. Source: Author, 2024

Appendix V: Letšema virtual and physical learning space



Note. This figure illustrates the dynamic learning process in the Letšema virtual and physical learning space, showcasing the interplay between physical community interactions and virtual learning platforms. Source: Author, 2024

Appendix W:The Mandhwane Action Research and co-creation process applied in the study



Note: This figure illustrates the adaptation of Khumbane's mind mobilisation approach applied in the research, indicating the iterative process and the co-creation of Mandhwane. Source: Author, 2024