

**Investigating Occupation as frame for planning and developing
Agricultural Extension VET skills for Climate Resilience: Cross-
case analysis of Alice, South Africa, and Gulu, Uganda**

Submitted in fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

by

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December 2023

Abstract

In sub-Saharan Africa and most of the Global South, climate change is challenging work and livelihoods for smallholder farmers who depend on rainfed farming, demanding climate resilience. Smallholder agriculture in Africa remains a mainstay for most economies and livelihoods, including South Africa and Uganda. My firsthand experience in Uganda as a subsistence farmer revealed the vitality of extension services to farmers. Participating in VETAfrica 4.0, a VET skill planning project, sparked my interest in examining the adequacy of 'Occupation' as a skills planning tool for addressing contemporary climate change challenges faced by extension officers and farmers, with implications for skills development.

This research sought to answer the question: What is the theoretical and practical history and current constitution of the agricultural extension officer occupation as a mediating unit of intervention for VET skills planning, and is it adequate for climate resilience? The study addressed five objectives. First, the study undertook a historical review of occupation as a mediating unit of intervention for skills planning. Secondly, the study examined current descriptions of the extension occupation as used for skills planning in Africa. Thirdly, in order to better understand the operationalisation of this skills planning instrument, the study examined aspects of skills development, specifically how VET preparation for extension work was taking place in response to the need for climate resilience through a curriculum review and the experiences and related work activities of extension services actors. The study also reviewed agricultural extension and VET policy, and labour market data for its responsiveness to climate resilience. In response to the findings of Objectives 1-4, a fifth objective was developed to offer expanded possibilities for a mediating unit of intervention for skills planning and development relevant to climate resilience in agricultural extension, as this appeared to be needed.

To develop the study, I drew on the Social Ecosystems Model (SEM) for skills, which raises the issue of mediation in skills development. I also drew on Cultural-Historical Activity Theory (CHAT) to help theorise the mediation in the SEM for skills, where different activity systems (policy, training and extension, farming) were present. This framework allowed me to probe how these activity systems were mediating climate-resilient skills development with/for extension services (or not).

Empirical data was produced through secondary and primary data, generated in two case study contexts using a cross-case design. Documentary analysis involved analysing policy documents, study curricula and historical literature to develop an understanding of historical sociology of occupation as a skills planning mediating unit and insight into contemporary understanding of how occupational frameworks are structured and deployed. Analysis was undertaken in two stages; firstly, through in-depth cases of occupation as mediating unit of intervention for skills planning, and aspects of skills development as influenced by this as influenced by this mediating unit (Chapter 5 and 6). This offered a first layer of analysis and insights into temporality, verticalities, mediation and horizontalities in the SEM for skills in each case. Secondly, abduction was undertaken to build models of the SEM for skills as found in each of the two countries using the SEM and CHAT analytical tools (Chapter 7), showing

the need for skills planning tools that are more closely related to and relevant to the contexts of skills development.

Findings revealed insights into the SEM for skills related to ecological time, notably a mismatch between the cultural-historical time of occupational skills planning and development, and the temporal demands for climate resilience. Historical analysis the deep rootedness of occupations and occupational structures in colonial histories and traditions, going back as far as the medieval era, with current occupations still bearing features of ancient occupational guild practices and hence not adequately responsive to climate change, affecting the SEM for skills in both cases and producing contradictions. Analysis further revealed that contemporary agricultural extension in Africa is decentralised and pluralistic, with few extension-related policies employed underdeveloped. Labour market in both South Africa and Uganda are not adequately orientated to climate resilience and fail to include climate resilience expertise, despite a need for this amongst farmers and by policy, revealing contradictions between various policy activity systems, which are not adequately facilitating. Empirical findings from study sites revealed that VET preparation for extension work lacks responsiveness to climate resilience within the skills ecosystem. Consequently, extension officers lack expertise in climate resilience, which is an increasing demand expressed by farmers and other horizontal activity systems in the SEM for skills.

Through a more complex understanding of the extension officer occupation and its development in skills ecosystem in Africa, the study proposes a broader mediating unit of intervention for skills planning than that of 'occupation' only. The mediating unit of intervention put forward for skills planning is a workstream mapping approach for climate resilient extension training in VET. This planning approach has implications for skills development viewed as work, learning and living involving more than one activity system in the skills development landscape, thus also broadening the approach to VET. The study concludes with recommendations to further test this approach. Finally, it makes recommendations that can inform: 1) curriculum innovation, 2) extension practice, 3) policy, and 4) research.

Acknowledgements

Reflecting upon this PhD journey, besides the hard work, I thank Jesus for giving me the strength to get through it.

I am very grateful to my scholarship sponsors. The VETAfrica 4.0 project graciously funded my first year, the Monitoring and Evaluation of Climate Communication and Education (MECCE) project supported my second, and the National Research Foundation (NRF) saw me through to completion. A special note of appreciation goes to the UK government and the Commonwealth Scholarship Commission (UK) for the PhD-Split-Site Scholarship, which enabled me to spend a transformative year at the University of Nottingham. This allowed me to learn and collaborate with leading experts in my field.

My supervisors enriched and guided my academic journey: Distinguished Professor Heila Lotz-Sisitka and Dr Presha Ramsarup, whose wisdom and patience were indispensable. I also thank Prof Volker Wedekind and Dr Jo-Anna Russon at the University of Nottingham for their supervision and invaluable insights during my split-site tenure.

Thanks to the ever-supportive team at the Environmental Learning Research Centre (ELRC), Rhodes University: Samantha, Thato, Danel and Carlene – your roles have been pivotal. My fellow scholars at the ELRC, including Robson, Ben, Maqwelane, Gamucharai, Maletje and Preven, have been an enduring source of inspiration and comradeship.

I'm equally grateful to the dedicated teams of the VETAfrica 4.0 project, RAEL project, and REAL Centre at Wits. Collaborating with such brilliant minds has enriched me both personally and professionally.

Lastly, my family has been my anchor. To my loving wife, Grace, and our cherished children, Zion, Leonie, and Liam – this work is a testament to your unwavering support and love. My father, Mr Robert Byamukama, and my siblings – Bruce, Norman, Carol, Osbert, Pamela, and Viola – your faith in me was a constant motivator. I remain forever grateful.

Dedication

I wish to dedicate this work to:

1. My dearest wife, Grace Muhangi, and our beloved children, Zion, Leonie, and Liam Muhangi – your understanding and patience during the countless times I was engrossed in my studies mean the world to me. Your sacrifice and enduring my absences made this achievement possible.
2. All the research participants – farmers and extension officers in Alice and Gulu. I also wish to dedicate the work to the devoted students and staff at Fort Cox College and Gulu University who participated in this study. Your willingness to share your experiences and insights was invaluable.

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Acronyms

AES	Agricultural Extension Services
AET	Agricultural Education Training
AFAAS	African Forum for Agricultural Advisory Services
AgriSETA	Agricultural Sector Education and Training Authority
ANC	African National Congress
AUC	African Union Commission
BTVET	Business Technical Vocational Education and Training
CAADP	Comprehensive African Agricultural Development Programme
CASP	Comprehensive Agricultural Support Programme
CHAT	Cultural-Historical Activity Theory
CHE	Council of Higher Education
CLRB	Communal Land Rights Bill
CAADP	Comprehensive Africa Agriculture Development Programme
CSA	Climate-Smart Agriculture
DBSA	Development Bank of Southern Africa
DHET	Department of Higher Education and Training
EFA	Education for All
EPWP	Expanded Public Works Programme
FFS	Farmer Field School
FCAFTI	Fort Cox Agriculture and Forestry Training Institute
FSP	Farmer Support Programme
GDP	Gross Domestic Product
GEAR	Growth Employment and Redistribution
GFRAS	Global Forum for Rural Advisory Services
ICT	Information and Communication Technologies
IFSS	Integrated Food Security Strategy
ILO	International Labour Organisation
ISCO	International Standard Classification of Occupations
ISRDS	Integrated Sustainable Rural Development Strategy

LRAD	Land Redistribution for Agricultural Development
LRPP	Land Reform Pilot Programme
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MDG	Millenium Development Goal
NAADS	National Agricultural Advisory Services
NAP-Ag	National Adaptation Plan for Agricultural Sector
NGO	Non-Governmental Organisation
NDP	National Development Plan
NQF	National Qualifications Framework
NSA	Non-State Actor
OFO	Organising Framework for Occupations
PLAS	Proactive Land Acquisition Strategy
PRDP	Peace, Recovery and Development Plan
RDP	Reconstruction and Development Programme
RPL	Recognition of Prior Learning
SACNASP	South African Council for Natural Scientific Professions
SAIEX	South African Institute for Agricultural Extension
SASAE	South African Society for Agricultural Extension
SDG	Sustainable Development Goal
SEM	Social Ecosystems Model
SSP	Skills Sector Plan
TLGF	Traditional Leadership and Governance Framework
TVET	Technical Vocational Education and Training
UBOS	Uganda Bureau of Statistics
UK	United Kingdom
UPDF	Uganda People's Defence Forces
US	United States
USAID	United States Agency for International Development
VET	Vocational Education and Training

CHAPTER 1: INTRODUCTION

1.0 Introduction

The first chapter of this thesis introduces the study and begins with an overview of Sub-Saharan Africa's agriculture. It highlights how vulnerable agriculture is to new challenges, especially climate change. This chapter also summarises the history of extension services in Africa and emphasises the importance of the extension officer occupation in shaping skills planning and skills development. Central to this discussion is the concept of occupation. Clarke (2011) offers a perspective on occupations as socially recognised categories that are governed by regulatory frameworks. These frameworks encompass various aspects such as vocational education and training, qualifications, and the spectrum of knowledge and skills necessary to execute tasks. This view highlights the importance of understanding occupations not only in terms of the tasks involved but also in relation to the broader skills planning and development and institutional structures that shape them. This study examines the adequacy of occupation as primary mediating unit of intervention for skills planning and its implications for developing skills for VET. As indicated in Chapter 2, occupation is also used for other purposes and plays other roles in the functioning of skills ecosystems, as will be further elaborated in Chapter 2, section 2.5.1. As a vehicle for skills development for extension occupation, this chapter further highlights how Vocational Education and Training (VET) skills planning and development emerged in the pre-and post-independence era in Africa, which aligns with the contemporary structuring of occupations. The chapter briefly highlights the theoretical framework employed by this study and outlines the research question and objectives. Furthermore, the chapter briefly highlights the study's methodology and provides a brief contextual profile for each case study site. The chapter concludes with a summary of the key concepts fundamental to the research and a thesis outline.

1.1 Motivation for the study

My motivation for focusing on smallholder agriculture and extension services in this study arises from three key factors: my family background and personal experience as a small-scale farmer and my academic background. Additionally, the significance of the VETAfrica 4.0¹ Collective research programme, in which I participated as a researcher, played a crucial role in shaping my research direction.

¹ To read more about the VETAfrica 4.0 project go to <https://www.vetafrica4-0.com>.

Growing up in southwestern Uganda, in a predominantly agricultural rural area where smallholder farming serves as the primary source of income and sustenance for the community, I witnessed firsthand the hardships that many households faced. During my upbringing, I actively engaged in subsistence farming, acquiring valuable skills and insights into agricultural practices. These experiences ignited my profound passion for agriculture. This passion grew stronger as I realised extension's crucial role in addressing evolving farming complexities, driving me to contribute to research on enhancing smallholder farmers' resilience through extension services. Having a background in Business Management and Food Security, my academic pursuits seamlessly intertwined with my growing interest in the realm of skills development. I was then drawn to the VETAfrica 4.0 Collective Research programme, in which I focused on the extension occupation in two of the four case studies focusing on skills development in agricultural contexts. This project sought insight into relevant mediating tools for skills planning and associated implications for skills development, of which 'Occupation' is a dominant tool, both in South Africa and Uganda. Furthermore, it looked at complex challenges of sustainability and inclusivity, which had been left out in skills planning systems. This trajectory informed my PhD study, and I was particularly interested in studying extension occupation, a domain currently undergoing a significant shift in light of climate change challenges. My focus centred on researching extension services and gaining insight into the evolving role of extension officers to understand the ways in which this role is being redefined as well as possibilities for new approaches of planning and developing skills to address the dynamic complexities in agriculture presented by climate change.

1.2 Study background and research focus

Agriculture stands as an anchor of economies and livelihoods across Sub-Saharan Africa (SSA) and other Global South countries. According to World Bank statistics (2022a), a considerable portion of the population in these regions is engaged in agricultural activities. For instance, in countries like India, Afghanistan, and Bangladesh, approximately 43%, 47%, and 37% of the population respectively are employed in agriculture, primarily comprising smallholder farmers. However, this study specifically centers its focus on Sub-Saharan Africa. Statistics reveal that agriculture contributes approximately 23% of Sub-Saharan Africa's Gross Domestic Product (GDP) and engages over 60% of the continent's population, primarily through smallholder farming (Goedde et al., 2019; Mutimba, 2014). This holds remarkable significance because around 70% of Sub-Saharan Africa's inhabitants are based in rural areas, with over 90% of this

demographic relying on agriculture for their income (Mutimba, 2014). Notably, smallholder agriculture plays a pivotal role at the household level within numerous rural contexts, particularly in economies entrenched in agriculture (Raidimi & Kabiti, 2019). The significance of agriculture to economic development and robust livelihoods is underscored across numerous African countries. In South Africa, as an example, the agricultural sector supports over two million active smallholder farmers, while commercial farming employs more than 860,000 individuals (Agricultural Sector Education and Training Authority [AgriSETA], 2020). Likewise, in Uganda, subsistence agriculture and related value-chain employ over 80% of the rural population, with the sector contributing 85% of the country's export earnings (Ministry of Agriculture, Animal Industry and Fisheries [MAAIF], 2018; World Bank, 2021a).

Although agriculture is a primary pillar for economies and livelihoods across many SSA countries, its productivity in the region has lagged behind its global counterparts. SSA's agricultural productivity has failed to keep pace with its burgeoning population (Adolph, 2011). The Organisation for Economic Cooperation and Development (OECD) states that SSA is home to more than 200 million individuals aged 18-24 (as of 2020), a number set to rise to 275 million by 2050 (OECD, 2020). Additionally, the labour force will witness an influx of over 17 million youth annually by 2025 (International Labour Organisation [ILO], 2020). This underscores the imperative for the agricultural sector to provide sustainable employment opportunities for the growing youth demographic while also supporting the livelihoods of numerous smallholders. Further statistics highlight that agricultural per capita production in SSA has remained stagnant since the 1980s, highlighting SSA's unfortunate distinction as the world's most undernourished population. According to the state of global food security report, an estimated 278 million individuals in SSA continue to face hunger (FAO et al., 2022). This situation is often attributed to the underutilisation of the continent's agricultural sector, despite its significant potential to uplift livelihoods and address poverty and food insecurity (Goedde et al., 2019). As aptly put by Borlaug, "the potential is there, but you can't eat potential" (Denning, 2010, para 1). This statement emphasises the necessity of translating this agricultural 'potential' into concrete strides towards inclusive and sustainable development across Africa.

A promising avenue to unlock this potential, especially in addressing food insecurity and poverty, lies in effective agricultural extension systems (Abdu-Raheem & Worth, 2011; Mutimba, 2014). Agricultural extension encompasses a comprehensive scope, defined as the systematic effort to enhance farmers' agricultural knowledge and skills, thereby facilitating

improved farm yields and other favourable transformations (Collett & Gale, 2009). This process incorporates elements of public awareness, active engagement, and information accessibility through educational and training initiatives (Ozor & Nnaji, 2011).

Vocational Education and Training (VET) plays a critical role in developing skills, knowledge, and other work-related competences within agricultural extension as a distinct vocation. Moodie (2002) defines VET as the development and application of knowledge and skills tailored to middle-level occupations essential to societal needs from time to time. From a traditional understanding of VET, vocational skills were predominantly associated with practical or technical expertise, focusing on hands-on applications in various trades such as bricklaying, carpentry, and plumbing. However, in this study, the understanding of vocational skills is not limited to what is known concerning vocational skills. It has evolved to encompass a wider spectrum of professions, including extension work. Agricultural extension, as a vocation, pertains to the specialised occupation of extending agricultural knowledge and practices to farmers, particularly smallholders, in contexts like Sub-Saharan Africa and the broader Global South. The concept of 'occupation' which is regarded as the primary unit of mediation for skills planning and skills development forms the focus of this study particularly the extension occupation. By recognising agricultural extension as a vocation, this study acknowledges its significance and its location in VET.

Essentially, extension services in SSA are critical to agriculture, in particular to smallholder farmers by assisting in the transfer of knowledge from researchers and extension agents to farmers to promote desirable agricultural development (Msuya et al., 2017). Nevertheless, the lack of access to extension services by smallholder farmers remains a major challenge for most SSA governments. Sub-Saharan African governments' role in providing direct extension services to farmers has drastically diminished due to committing to market-based and structural adjustments for agricultural development (Mutimba, 2014). Across many nations, the availability of services like extension and credit provision through government-associated commodity-based production and marketing boards has dwindled. This transformation has paved the way for private extension service providers to step in, offering assistance to farmers. However, it is unlikely that these private entities can comprehensively fill the void left by the state in adequately supporting farmers (Mutimba, 2014; Stringfellow et al., 1997).

Governments across SSA have recognised this reality and acknowledged both the potential of agricultural extension services and the detrimental implications of leaving extension solely to

private providers. This awareness has led to proactive measures. In 2003, SSA governments embraced the Comprehensive African Agricultural Development Programme (CAADP), followed by the 2021 adoption of the FAO-African Union Commission (AUC) framework on agriculture (FAO & AUC, 2021). These strategic blueprints prioritise substantial investments in agricultural research, public extension services, education, and training to bolster agricultural productivity. The consensus prevails that dedicating resources to knowledge production will undoubtedly empower farmers to realise the anticipated benefits from their agricultural undertakings (Goedde et al., 2019).

Besides institutional bottlenecks such as limited funding and government support, literature has further shown that there is still a gap among smallholder farmers' productivity mainly due to information, knowledge, resource, and skills deficit that constrain the uptake of new and improved technologies and farm management practices (Bjornlund & Pittock, 2017; Tire, 2006). This challenge has become more evident as the agricultural landscape keeps changing amidst pressures on agriculture from emerging issues, mainly climate change and its induced impacts. The crops and the food chain that farmers, their families and communities depend on for survival and income are fragile due to climate variability, exacerbating food insecurity for millions of people (World Bank, 2022b).

In addition to knowledge and skills gaps among smallholder farmers, various social and institutional factors also influence their climate resilience, particularly in the context of poverty and limited governmental support. For example, as highlighted by Chisoro-Dube et al. (2021), smallholders in South Africa face challenges accessing climate-smart technologies due to financial constraints. Without government support, they are unable to afford these technologies, further hindering their ability to adapt to climate change.

Against the backdrop of climate variability and its rapid and unpredictable environmental changes, agricultural extension services have become more prominent, primarily concerning knowledge dissemination. The escalating risks propelled by climate-induced factors-ranging from drought and erratic rainfall to heightened occurrences of pests and diseases-pose daunting threats to food production and, subsequently, food security among resource-constrained smallholder farmers (Campbell et al., 2014). Similarly, the evolving complexities and uncertainties ushered in by climate change have infused dynamism into extension work, rendering it a less fixed occupation. This stems in part from the expectation that extension

services should equip smallholder farmers with adaptive capacities, imparting knowledge and fostering innovative sustainable practices that foster resilience against climate change. Such endeavours are pivotal for safeguarding crops against extreme climatic events like drought (Adenle et al., 2017). Ultimately, the emerging climate-related challenges confronting agriculture are shaping the nature of extension services, profoundly influencing the role played by extension officers in bolstering farmer resilience.

In the context of climate-induced challenges, the role of agricultural extension officers is paramount in bolstering farmers' capacity to both adapt to and mitigate climate-related risks. This critical function is primarily facilitated by establishing connections between farmers and various sources of knowledge and information and enabling farmers to acquire sustainable agroecological practices, fostering the generation of knowledge (including indigenous farming knowledge), and cultivating the essential proficiencies needed for sustainable production (Abdu-Raheem & Worth, 2011). In the pursuit of enhancing climate resilience, extension officers could aid farmers in incorporating communicative interventions to facilitate the adoption of contemporary technologies and innovations aimed at addressing these pressing ecological challenges (Leeuwis, 2013). Additionally, Ozor and Nnaji (2011) posited that extension services must encompass knowledge brokerage and awareness creation concerning climate change matters. This proactive approach is instrumental in assisting vulnerable smallholders and communities in adapting to and mitigating climate-related risks. Some scholars underscore the insufficient integration of sustainability knowledge and skills within extension services, revealing a gap in extension education and training. Rosenberg (2020a) suggested that a deficiency in sustainability expertise hampers extension officers' capacity to bolster smallholder farmers' resilience against climate change-related risks due to the omission of such expertise from their educational curriculum. This observation sheds light on the limitations of the extension officer occupation in effectively addressing contemporary climate challenges and in strategically developing required skills for the workforce to perform work-related activities and planning future skills needs amidst the changing environment.

In this study, it is crucial to differentiate between skills planning and skills development, as they represent distinct concepts with unique implications. Skills planning involves systematically analysing and forecasting the present and future skills requirements within a specific sector, industry, or economy (Allais, 2022). De Bruecker et al. (2015) further stress that skills planning also delves into planning for resource allocation and ways of managing the

diversity of skills required or what future workforce may possess. Conversely, skills development pertains to the process of enhancing the workforce's capabilities through education and training (Akoojee, Mcgrath & Gewer, 2015; Allais, 2011)

This study focuses on the occupation as the unit of analysis for vocational education and training (VET) skills planning and skills development in Africa and to the specific countries under examination. While literature on skills planning tends to emphasise analysis and forecasting of skills demands, I did not take this approach to skills planning research in this study. Instead, I sought to deepen insight into how skills planning instruments, in this case occupation as a key mediating unit of intervention for skills planning functions. This took me into historical analysis of the concept of occupation and its construction as a mediating unit of intervention in skills planning, and also took me into understanding how the mediating unit influences other tools such as curriculum, policy, and labour market tools. As a result, I needed to probe skills development processes as influenced by this mediating unit of intervention in skills planning qualitatively and conceptually.

As a result, the study critiques the conventional approach to use of occupation as a mediating unit of intervention for skills planning, arguing that the construct of occupation often leads to overly specialized, and rigid planning frames. In this instrumentality, it fails to reveal its rootedness in historical contexts, with the result that it limits the skills planning and development systems to address contemporary challenges, particularly those related to climate change. Therefore, the study advocates for reimagining occupations as a mediating unit of intervention for skill planning and development, emphasising the importance of aligning skills development with the evolving demands of the workforce, and the work, living and learning skills the future may demand in the face of climate change-related challenges.

By reconceptualising occupations to become more flexibly interpreted within related workstreams and articulated within social-ecological contexts of skills development, and therefore also more inclusively, it is hoped that this will facilitate more agentic and responsive approaches to skills planning and development that can effectively address climate related and environmental challenges affecting work and living.

As will be discussed in more detail in Chapter 2, it is worth noting that the structuring of occupations as instruments for skills development is deeply ingrained in education and Vocational Education and Training (VET) planning mechanisms that are arguably influenced

by outdated VET accounts designed for Africa. The prominence of VET in Africa as a structure for skills planning and development, can be traced back to the colonial era. This approach (which had a Eurocentric orientation) gained traction in Africa during the mid-20th century, coinciding with the drive for independence among African nations from the 1940s onwards. VET was introduced to cultivate skills for economic development in post-independence Africa (McGrath, 2011). McGrath (2011) has presented three distinct phases characterising the evolution of VET in Africa: modernisation, basic needs, and neoliberalism. The inaugural phase emerged during the post-World War II transition period, spanning from the mid-1940s to the late 1960s. It was supported by post-independence economics, emphasising widespread education and industrialisation-driven growth (McGrath, 2018).

The second phase of VET planning in Africa emerged as a response to concerns about the potential for educated unemployment. During this phase, the focus shifted towards meeting basic needs, particularly by providing skills and training for the urban informal sector and rural settings (McGrath, 2018; Van Rensburg, 1974). In the agricultural sector, for example, the World Bank supported the implementation of demand-driven extension models in African countries to support rural population (Swanson, 2008). However, this direction of VET planning proved to be ineffective, leading the World Bank to prioritise primary education over Higher Education and VET through structural adjustment programs (McGrath, 2018). These reforms granted public institutions and private businesses greater autonomy and influence at local and national levels. They introduced outcomes-based models, funding mechanisms, national qualifications frameworks, and competence-based curricula aligned with occupational structuring (Allais, 2003; McGrath, 2012; McGrath et al., 2018). Despite these changes, the basic skills of VET structuring remained inadequate, giving rise to a new neo-liberal phase of VET planning.

The third phase of VET planning, characterised by a neoliberal approach, was championed by the World Bank to introduce a revised version of public VET, coupled with new policy conditions (Apostolopoulou & Adams, 2015). For instance, in Uganda, the World Bank-supported reforms and conditionalities advocated for processes like privatisation, liberalisation, and decentralisation, which eventually undermined the public extension system. Consequently, these reforms led to the reorganisation of the Ministry of Agriculture and the reduction of extension staff, thereby generating a high extension officer-household ratio and impairing the effectiveness of skills development in the agricultural sector (Semana, 1998).

Despite the formulation of the Millennium Development Goals (MDGs) and the Education for All (EFA) policy, these frameworks fell short in emphasizing critical sustainability elements, such as sustainable production and consumption and decent work (McGrath et al., 2018; United Nations, 2015). VET planning phases 1 through 3 exhibited a lack of alignment with the contextual realities of African nations and their economies. Instead, they heavily relied on historical occupations (discussed in Chapter 2) as the primary mechanisms for mediating skills planning and development.

Amid the complex challenges posed by climate change, the adequacy of traditional occupational structures and the corresponding previous VET models (1-3) are now being called into question. Buchanan et al. (2020) underscore the urgency of the climate crisis, which potentially eclipses other emerging global megatrends that affect the future of work and livelihoods. Given this backdrop, it is imperative to assess the effectiveness of established structures in addressing these multi-layered challenges.

Occupations have historically provided a framework for mapping educational achievements to job requirements, a method quantified through certification measures like degrees and diplomas (Handel, 2022). Yet, these structures are increasingly criticised for their transience, inconsistency, and bureaucratic nature (Ramsarup, 2020; Tolbert, 1996). Such criticisms indicate potential inadequacies in the current occupational structuring and skills development when confronting the emerging and complex challenges posed by issues like climate change.

Recognising these challenges, there is an emerging shift towards the development of a new VET model, VET 4.0 in Africa. This emerging model emphasises skills development that is aligned with the Sustainable Development Goals (SDGs), catering to the unique contexts of African nations (VETAfrica 4.0 Collective, 2023). VET 4.0 prioritises a blend of the formal and informal sectors, a characteristic especially prevalent in African context, mainly the agricultural sector. This approach mirrors the realities on the ground, making the model more aligned with the developmental needs of African countries. The current study intended to probe the adequacy of the occupation (focusing on the extension officer occupation) as a mediating unit of intervention for skills planning and implications for skills development currently aligning with the previous three VET accounts. Arguably, VET frameworks tailored for Africa should shift towards a holistic sustainable development perspective that brings together societal, economic, and environmental aspects. Such a perspective would inherently value the

blend of informality and formality, thereby ensuring a higher degree of contextual relevance in skills planning, development and work (VETAfrica 4.0. Collective, 2023).

Furthermore, as environmental and climate-related challenges intensify, there's a shift in the required skill sets for professionals like extension officers (Davis and Terblanche, 2016). The agricultural sector, especially smallholder farmers, are affected disproportionately by these changes, necessitating a reimagining of VET structures and mediating units for planning and developing skills. Instead of an overemphasising productivism, the new VET account should focus on creating adaptive capacities to adapt and mitigate climate challenges (VETAfrica 4.0. Collective, 2023).

Given this context, in this research which formed part of the VETAfrica 4.0 Collective Programme, I was curious to investigate whether the concept of 'Occupation' as the primary mediating unit for skills planning for VET was adequately constituted to address the present-day climate challenges encountered by extension officers and farmers. To develop the study, I drew on the Social Ecosystems Model (SEM) for skills, which raises the issue of mediation in skills development. Hodgson and Spours (2019) refer to SEM for skills as an inclusive approach to skills development that brings together a variety of social partners/stakeholders around the relationship of working, living, and learning. However, the SEM for skills is a broad and overarching macro-level analytical framework that offers tools for regional interpretation of skills development and related relations but lacks specificity and strength in theorising mediation. I, therefore, drew on Cultural-Historical Activity Theory (CHAT) to help theorise the mediation in the SEM for skills, where different activity systems (policy, training and extension, farming) were present. CHAT is useful in understanding how humans transform the world through activities that are "historically situated and materially and socially mediated" (Roth et al., 2012, p. 6). This framework allowed me to probe how these activity systems were mediating climate-resilient skills development with/for extension services (or not) as will be explained in chapters 5 and 6 and discussed in Chapter 7 of this thesis.

1.3 Research question and objectives

Considering the provided background and context, this study aimed to address the primary research question: What is the theoretical and practical history and current constitution of the

agricultural extension officer occupation as a mediating unit of intervention for VET skills planning, and is it adequate for climate resilience?

In answering the research question, the study aimed to examine the adequacy of an occupation as a mediating unit for climate resilience skills planning and its implications for skills development, focusing on the agricultural extension officer occupation. The specific objectives to achieve this broad aim included:

1. To conduct a historical review of occupation as a mediating unit of intervention for skills planning and development
2. To examine current descriptions of the extension occupation in Africa
3. To examine how VET preparation for extension work takes place in response to the need for climate resilience through a curriculum review and the experiences and related work activities of extension services actors
4. To review agricultural extension and VET policy, and labour market data for its responsiveness to climate resilience
5. In response to the findings of Objectives 1-4, offer expanded possibilities for a mediating unit of intervention for skills planning and development relevant to climate resilience in agricultural extension, if required.

1.4 Research design and study sites

This qualitative study utilised a combination of literature review and an exploratory cross-case design to investigate phenomena in two distinct locations: Alice in Eastern Cape, South Africa, and Gulu in northern Uganda, with both being in focus of VETAfrica 4.0 collaborative research programme to which this study contributed. The cross-case study design, often employed for investigating multifaceted phenomena, was chosen to address complex real-world issues that lack singular outcomes (Tetnowski, 2015; Yin, 2018, 2003). To better understand real-world phenomena, I employed a constructivist paradigm. Within the context of this thesis, the constructivist paradigm posits that reality is not an objective entity external to the researcher, but rather, knowledge and interpretations of reality are shaped by cultural and historical contexts (Moon & Blackman, 2014). The SEM for skills and CHAT theoretical framework served as foundational ontological and epistemological underpinnings for this study.

As discussed in more depth in Chapter 4, this study generated both primary and secondary data through desktop research, documentary analysis and interviews. Secondary data involved

reviewing historical materials related to occupations and occupational classificational frameworks, study curriculum, and policy resources. Primary data was collected through personal and focus group interviews, as well as the analysis of the Climate Resilience Assessment Tool during completed in focus group sessions, as elaborated in Chapter 6, section 6.6. Recorded interviews were transcribed using Otter platform, and the resulting data was subjected to thematic analysis using NVivo software. The subsequent section briefly describes the case study sites for this research, with each case elaborated in more depth in Chapters 5 and 6.

1.5 Description of the study sites

This section introduces the study sites where the research was carried out in South Africa and Uganda.

1.5.1 Contextual profile for Case Study 1: Alice

As will be elaborated further in Chapter 5, Case 1 of this study centred around the town of Alice and its neighbouring rural areas within the Raymond Mhlaba municipality, located in the Amathole district of the Eastern Cape province in South Africa. This geographical area, depicted in Figure 1.1, holds historical significance as it was previously designated as a Bantustan homeland during apartheid. The past government policies of segregation have left a lasting impact of marginalisation and poverty in the region, which continues to be felt today (Lotz-Sisitka & McGrath, 2023). Historical circumstances have played a pivotal role in shaping this region's current state of underdevelopment, marked by limited economic activity, widespread poverty, and limited employment prospects (Westaway, 2012). The local population relies heavily on smallholder agriculture, with approximately a quarter (25.6%) of households engaged in agricultural activities (Statistics South Africa, 2016). Although its contribution of about 3% to the local economy is small, smallholder farming remains a crucial source of household sustenance for many residents (Lotz-Sisitka et al., 2018; Westaway, 2012). Citrus production and game farming stand out as this region's predominant commercial farming activities. Alongside these are smaller-scale agricultural practices encompassing poultry, livestock, vegetables, and various forms of mixed farming, as elaborated upon by Lotz-Sisitka et al. (2018).

The region experiences limited rainfall, resulting in below-average annual precipitation levels. This area was pinpointed by the Amanzi [water] for Food project as grappling with challenges

such as underdeveloped small-scale farming, poverty, and water scarcity (DAFF, 2018; Lotz-Sisitka et al., 2018). Notably, the study site houses an agricultural TVET college and the Fort Cox Agriculture and Forestry Training Institute (FCAFTI). This institute provides training for extension officers through its Diploma in Agriculture programme.



Figure 1.1: A map of South Africa showing the location of Case 1 in the Eastern Cape province
 Source: <http://exploringafrica.matrix.msu.edu/module-twenty-nine-activity-one>

1.5.2 Contextual profile for Case Study 2: Gulu

As will be elaborated further in Chapter 6, Case study site 2 is based in the city of Gulu and its surrounding areas, as shown in below in Figure 1.2. Gulu attained city status in 2020 and is the major centre in Acholiland in northern Uganda. About 70% of the population is below 30 years, and most of these young people are unemployed (Lotz-Sisitka & McGrath, 2023). Acholiland suffered a 20-year civil (1986-2006) war between the Lord’s Resistance Army rebel group and government forces which significantly affected economic activities, mainly agriculture, which is people’s main source of livelihood (Branch, 2013). In the aftermath of the conflict, agriculture in Gulu holds promise for numerous individuals, particularly smallholders and youth, to bolster their incomes and contribute to the local economy. However, the region

grapples with substantial deforestation due to the illicit charcoal trade, hastening land degradation and exacerbating the impacts of climate-induced events. The area already contends with frequent droughts and floods, which disproportionately affect farmers employing traditional cultivation techniques (Mugonola & Baliddawa, 2014). The local government’s limited capacity to address socio-economic and ecological difficulties has hindered agricultural development (Lotz-Sisitka & McGrath, 2023). Moreover, agricultural extension services crucial for enhancing climate resilience and skill development face a range of challenges, including politicisation (Löwe & Phiona, 2017). Within this study site, Gulu University is the region’s largest post-school institution, offering extension education and training primarily through a Bachelor of Science in Agriculture program designed to train extension officers.



Figure 1.2: Map of Uganda showing study site of Gulu district
 Source: <https://www.nationsonline.org/oneworld/map/uganda-administrative-map.htm>

1.6 Key concepts of the study

Skill ecosystems: Chapter 3.1.1 describes the origins of the skills ecosystems concept to the current configuration in skills development. Finegold (1999) characterised skills ecosystems as configurations within specific regions or sectors where human abilities are honed for production purposes. Skills ecosystem represents a collaborative paradigm between industries and VET, closely aligned with ‘workforce development’ (Buchanan et al., 2017). Finegold’s studies centred on the determinants that facilitate the high-skills formation in Silicon Valley’s IT and biotechnology context. The model has influenced practical policy frameworks for skill development, predominantly in advanced nations. Notably, prior models of skills ecosystems focused on high and middle skills from developed regions (as seen in Buchanan et al., 2017; Finegold, 1999; Windsor & Alcorso, 2008) and often overlooked the rudimentary and informal skills common in developing nations. Pivoting from this trend, Hodgson and Spours (2016) introduced the Social Ecosystems Model (SEM) for skills, a comprehensive model encompassing formal, informal, and on-the-job learning, fostered through a blend of vertical facilitation and horizontal collaboration (See also Spours, 2023). In this study, the SEM for skills model served as the overarching conceptual structure, elaborated further in Chapter 3, from section 3.2.

Occupations: In skills ecosystems, the occupation emerges as the primary frame for skills planning and skills development. Freidson (1985) elucidates the concept, describing an occupation as an ensemble of tasks, bundled into roles, shared by workers dedicated to a common activity, who then pass on their established methodologies to newcomers. Meanwhile, Clarke (2011) perceives an occupation as a socially recognised category, underpinned by a regulatory framework that governs aspects like vocational education and training, qualifications, and the spectrum of knowledge, both pragmatic and theoretical, essential for its execution. These occupations are bound together by a “common disciplinary knowledge, skills, and capabilities” within an overarching domain of practice as articulated by Yu, Bretherton and Buchanan (2013, p.44). Delving into the concept of occupation, Chapter 2 traces its evolutionary trajectory, highlighting its longstanding role in structuring work, labour, and anchoring skills planning and skills development.

Workstreams: ‘Workstreams’ denote streams of work, distinguishing itself from similar terms like ‘vocational stream’ ‘job’ and ‘labour’ (Standing, 2009). Unlike ‘job’ and ‘labour’, ‘work’ encapsulates both conception and execution in productive activities, offering autonomy and

satisfaction (Standing, 2009; Shalem & Allais, 2018). Workgroups engaging in such activities bring diversity of skills and knowledge, spanning from the formal, informal and specialised skills and knowledge (World Economic Forum, 2011). For clarity, a workstream differs from a vocational stream. Although a ‘workstream’ and a ‘vocational stream’ bear resemblance in that both must be in sync with shared disciplinary knowledge, skill sets, and capabilities inherent to a broader practice domain (Yu et al., 2013), they deviate in their core definitions. Vocational streams represent shared attributes across multiple occupations, on the contrary a ‘workstream’ does not adhere strictly to any particular occupation. Instead, it is broader and fluid, aligning itself with bodies of shared foundational knowledge (or core knowledge) and skills from varied backgrounds and occupations to perform tasks requiring a mix of competencies (Yu et al., 2013). This study mapped workstreams to understand VET’s provisioning in response to climate resilience, through core knowledge and competencies applicable across related occupations, highlighting overlaps and divergent specialisation across different occupations.

Mediated action and activity. Mediation stands out as a critical concept in this research. In the SEM for skills context, mediation is seen as an intervening process within the relationships among various players, present in both vertical and horizontal dimensions of the skills ecosystem. These mediators work to cohesively bind the vertical and horizontal dimensions, bringing together work, living, and learning experiences (Hodgson & Spours, 2021). The intersection of these dimensions is termed the ‘45-degree activity’, where the facilitating verticalities and collaborative horizontalities merge (Hodgson & Spours, 2016, 2018, 2019; Spours, 2021, 2023). In a parallel manner, Cultural-Historical Activity Theory (CHAT) views mediation as the active involvement of external entities, such as systems, institutions, or individuals. It underscores the role of materials, symbols, and tools in fostering the desired transformation by various actors and activity systems and offers a process of framing of mediation (Cong-Lem, 2022; Engeström, 1987; Gillespie and Zittoun, 2010; Wertsch, 2007). The similarity in perspectives on mediation in both SEM for skills and CHAT is highlighted by their mutual emphasis. Both emphasise the deliberate involvement of external forces using material tools, or symbols (Wertsch, 2007). As detailed in chapter 3, this research positions CHAT within SEM for skills to theorise the mediation space, represented as process engagement between interacting activity systems in the SEM at the 45-degree activity (see also Chapter 7).

Agricultural extension: While there is no universally accepted definition for agricultural extension, it is commonly understood as the application of scientific knowledge and innovative agricultural practices through the education of farmers (Cohen & Lemma, 2011). Worth (2006) identifies two primary aspects of extension in agriculture: human development and technology transfer. Röling (1988) elucidates on various widely recognised models of extension, which are detailed in Chapter 2, section 2.9. The history of extension services in Sub-Saharan Africa is charted in section 2.6, while Chapters 5 and 6 provide in-depth perspectives on the evolution of extension services and agricultural education in South Africa and Uganda to better contextualise findings from respective case study sites.

Climate change and climate resilience: There is increased consensus globally that climate change is an existential threat to lives and livelihoods. According to the Intergovernmental Panel on Climate Change (IPCC), Climate change is referred to as any change in climate over time, whether due to natural variability or as a result of human activity². The IPCC has released its Synthesis Report for 2023, delivering a critical and comprehensive assessment of the state of the climate and the profound impact human actions have on our planet. This report, grounded in rigorous scientific research, affirms beyond doubt that human activities-principally the emissions of greenhouse gases from unsustainable energy practices, changes in land use, and changing production and consumption patterns are significantly influencing weather and climate extremes (IPCC, 2023). The report further indicates that these weather and climate extremes are causing widespread impacts on food and water, disproportionately affecting vulnerable communities that least contribute to greenhouse emissions. In the context of this study, climate change predominantly denotes the local climate-induced impacts felt by vulnerable smallholder farmers, including seasonal variations, flooding, pest infestations, diseases, and droughts. Ward (2022) emphasises that as climate change introduces unprecedented challenges to agriculture, bolstering climate resilience becomes paramount to ensure sustained livelihoods. Denton and colleagues define climate resilience as the capacity of socio-ecological systems to foresee, reduce, adapt to, and swiftly recover from negative climate impacts (Denton, et al., 2014). They highlight two primary approaches to building resilience: mitigation and adaptation. Mitigation involves proactive measures to moderate potential threats, ensuring they remain at manageable levels. In contrast, adaptation encompasses strategies to cope with and adjust to adverse climate effects, while ensuring

² See the definition of climate change in IPCC glossary of terms at <https://www.ipcc.ch/site/assets/uploads/2018/03/wg2TARannexB.pdf>

sustainable development continues (Ward, 2022; IPCC, 2023). Tyler and Moench (2012) argue that fostering climate resilience demands coordinated and proactive efforts from a diverse set of players, encompassing public institutions, private entities, and civil society organisations.

Vocation and Vocational Education and Training (VET)

Moodie (2002) observes Vocational Education and Training (VET) as a complex concept that has evolved over time, adapting to the changing needs and contexts of societies. The understanding of VET inclines towards Anglo-north epistemologies in countries like Canada, the United Kingdom, and Australia. Moodie suggests that VET cannot be defined using a singular characteristic, positing that VET's definition embodies a combination of characteristics. These include epistemological, such as the development of distinct learning methods tailored to specific fields; teleological considerations, which concern VET's purpose and relevance to society; and hierarchical, considering factors like occupational, educational, or cognitive levels. Finally, Moodie emphasises the pragmatic aspect of VET, highlighting that it lies between secondary and tertiary levels of education, providing skills for middle-level occupations. Overall, Moodie's analysis suggests that vocational education and training are the development and application of knowledge and skills for middle-level occupations needed by society from time to time.

Buchanan, Yu, Marginson and Wheelahan (2009) define a vocation as a merger of interconnected knowledge and skills that facilitate individuals' advancement within a specific vocational stream or that enables lateral transitions into related occupations. They emphasise the continuum of knowledge and skill inherent in a vocation, bridging the realms of work, vocational education and training, and higher education. According to Buchanan et al. (2009), a vocation hinges on accumulating skills coherently and progressively, underscoring the importance of a structured and cumulative approach to skill development.

1.7 Outline of the thesis

Chapter 1: Introduction

Chapter 1 serves as an introduction to the thesis, explaining the thesis background through contextualising agriculture within Sub-Saharan Africa. It underscores the sector's significance in terms of livelihoods and economies, along with the climate risks encountered by smallholder farming. Emphasis is placed on the potential of extension services in fostering climate resilience among smallholder farmers. Furthermore, the current structure of occupation is identified as a pivotal to skills planning and skills development interventions. The research

problem and the central objective of the study are described, underscored by the necessity to reimagine the mediating unit of intervention for skills planning with its implications for skills development. The chapter outlines the theoretical framework, the primary research question, and the specific study objectives. A concise overview of the methodology is provided, along with a short introductory profile of the two case study sites examined within the research. The chapter culminates by explaining key concepts employed throughout the study.

Chapter 2: Occupations as key mediating unit for skills planning and skills development

In this chapter, the thesis examines the historical sociology of occupations and the evolution of extension services in Africa. The concept of occupations and their developmental origins, as well as the state's role in their emergence and decline, are explained. The chapter further explores how occupational discourse permeated African skills planning systems, emphasising the pivotal role of occupations in planning and developing skills in this context. The chapter also elaborates the extension officer occupation, detailing its organisation, prevalent extension methodologies and approaches, professionalisation, policy context, role within extension services, and the impact of climate challenges on this occupation in the African context.

Chapter 3: Elaborating The Social Ecosystem Model for Skills to Investigate mediation of skills planning And development

This chapter discusses the theoretical framework utilised to address the overarching research question. Within this context, the Social Ecosystems Model (SEM) for skills and Cultural-Historical Activity Theory (CHAT) are introduced and explored as the principal theories underpinning this study. The chapter commences by elucidating the Social Ecosystems Model for skills, delineating its intrinsic features, application scope, and its pertinence to this research.

Subsequently, the chapter discusses Cultural-Historical Activity Theory (CHAT), tracing its historical evolution, outlining its distinctive characteristics and constituent elements, while concurrently explaining how it is used in this study to further theorise SEM for skills and underscoring the theoretical synergy between CHAT and SEM for skills. The chapter concludes by discussing the application of both SEM for skills and CHAT to the study and offers a conceptual visualisation of the integrated theoretical framework. Ultimately, the chapter endeavours to establish a robust theoretical foundation that underpins the study's analytical investigations, with implications for further research (cf. Chapter 7).

Chapter 4: Research methodology

The methodology chapter elucidates the study's methodological structure, encompassing the research paradigm, design, and foundational epistemological, ontological, and methodological assumptions. The Chapter delves into the selection of ontological and epistemic orientations, elaborating on the rationale behind adopting a cross-case study design. The chapter explicates the participant selection process, data collection methods, and subsequently, how data was analysed and presented. Lastly, the chapter concludes by addressing research quality and validity considerations relevant to the study's context.

Chapter 5: History and extension skills development in South Africa and Alice case

The chapter presents findings from Alice, South Africa. The chapter commences by establishing the contextual backdrop, delving into country-specific literature then and proceeds to present the empirical findings derived from the case study site. To provide a comprehensive context, the chapter offers an overview agricultural sector and a historical evolution of the agricultural extension officer occupation in South Africa, tracing its historical trajectory and delving into aspects like education and the professionalisation of extension services. Pertinent factors shaping extension services' development, including legislation, land issues during colonialism and the post-independence agricultural policy landscape in South Africa are discussed while also highlighting challenges confronting the agriculture and extension services in the country. The subsequent section presents the empirical findings from the Alice Case with insights derived from a blend of primary and secondary data sources, including key informant and focus group interviews, an examination of the occupational classification framework and labour market information, study curriculum, the Climate Resilience Assessment Tool, and Policy documents. This chapter presents a comprehensive exploration of the empirical findings, placing them within the broader context of the South African agricultural landscape.

Chapter 6: History and extension skills development in Uganda and Gulu case

Chapter 6 presents empirical findings pertaining to Gulu in Uganda. Consistent with the methodology of Chapter 5, this chapter begins with a contextual explication, offering a comprehensive historical and developmental landscape of extension services within the Ugandan context. It provides a comprehensive overview of Uganda's agricultural sector and chronologically describes the evolutionary trajectory of extension services in both pre-and post-independence periods. After this contextual introduction, the chapter transitions into the

exposition of empirical findings garnered from Gulu through personal and focus group interviews. The analysis also includes the study curriculum, the occupational classification framework (ISCO-08), labour market information, policy analysis, and the Climate Resilience Assessment Tool. Chapter 6 constitutes empirical insights encompassing historical and contemporary aspects of Uganda's agricultural and extension delivery system.

Chapter 7: Re-imagining Social Ecosystem for skills as mediating unit of intervention

Chapter 7 abductively discusses the findings in Chapters 5 and 6, adhering to the objectives set forth in Chapter 1, section 1.3. It offers a synthesis of insights gathered from both the literature review and the empirical data from distinct country-specific case study locations of Alice and Gulu, in which a model of activity systems found in the SEM for skills contexts is presented and elaborated, with reference to significant contradictions pointing to the points for advancing mediation in the SEM for skills in both cases. At its conclusion, considers the a workstream mapping approach that aligns with the activity systems analysis in the SEM for skills, and proposes the workstream mapping approach involving various activity systems to expand beyond identified limitations of occupation as main mediating unit of intervention for VET skills planning and its implications for skills development in the context of climate resilience.

Chapter 8: Conclusion and recommendations

The concluding chapter of the thesis encapsulates its entirety through offering a concise summary of the study and its primary findings. The chapter reflects on the theoretical framework developed in the study and offers an articulation of its contribution to the existing body of knowledge. Concluding the chapter, recommendations are provided addressing practice, policy, and future research. Study limitations are also outlined.

1.8 Chapter conclusion

Chapter 1 introduced the study and highlighted agriculture's role in Sub-Saharan Africa's livelihoods and economies. It further showed that agricultural extension services could address challenges in smallholder farming in the face of climate change, by facilitating transfer of knowledge and sustainable practices among farmers to enhance productivity and resilience. In addition, VET holds a promise for bridging the skills gap among agricultural extension smallholder farmers in Sub-Saharan Africa and specific countries under examination. However, VET still has limitations in developing skills for extension officers given the historical situatedness of existing VET phases, from modernisation to neoliberalism and

associated occupational structuring that are out of sync with the current place-based realities in Africa. VET 4.0, which prioritises sustainable development goals for holistic skills planning and development is highlighted as a potential for climate resilience in the skills ecosystem if occupation is reimagined. Overall, the chapter brought to the fore the central question of this research; considering its theoretical and practical history whether the current constitution of the agricultural extension officer occupation as a mediating unit of intervention for VET skills planning, and if it is adequate for climate resilience. Chapter 2 discusses occupations as units of skills planning and skills development.

CHAPTER 2: OCCUPATIONS AS KEY MEDIATING UNIT FOR SKILLS PLANNING AND SKILLS DEVELOPMENT

2.0 Introduction

Chapter 2 of the thesis tackles two study objectives: firstly, it offers an historical overview of occupations as mediating units for skills planning and skills development. Secondly, it touches upon the second objective which is to examine the current description of the extension occupation in Africa. For contextual understanding of extension in specific case study sites, this subject is expanded upon in subsequent chapters, specifically Chapter 5 (sections 5.2 to 5.3.3) and Chapter 6 (sections 6.2 to 6.4), where in-depth explorations into South Africa and Uganda respectively are presented. This chapter discusses the complex concept of occupations and traces their historical roots from medieval occupational guilds, through the transformative era of the Industrial Revolution, to contemporary factors that shape their emergence. The narrative then shifts to highlight the influence of Western imperialism, colonialism, and the pervasive wave of globalisation on the occupational discourse within African countries' skills planning systems. The chapter further discusses occupations as key features of skills planning and skills development in Africa's ecosystem. Furthermore, a subset of this discourse focuses the role of the 'Extension Officer' occupation in Africa, explaining its policy frameworks, the trajectory towards its professionalisation, and the array of models and approaches employed. With a particular focus on Sub-Saharan Africa, the chapter underscores the instrumental role of extension services. However, as the narrative evolves, it brings to the fore the pressing challenge of climate change and emphasises the dire need for a broader mediating unit of skills intervention in preparation for future work.

2.1 Understanding an occupation

The concept of occupation is complex and has evolved. For decades, occupations have been employed as primary units for structuring work and labour and as a unit of analysis for planning and developing skills. This concept has been studied extensively. Freidson (1985) for instance described an occupation as a combination of tasks in role bundles that exists when workers perform the same activity and develop common methods that are passed on to new recruits. According to Clarke (2011, p. 103), an occupation is a "formally recognised social category" that involves a regulatory framework encompassing aspects such as vocational education and training (VET), qualifications, promotion, and the encompassing range of practical and

theoretical knowledge needed to perform its tasks. This relates to Standing's (2009) definition which refers to an occupation as a social construct with an "evolving set of related tasks based on tradition and accumulated knowledge, part of which is unique" (p.11).

Irrespective of the specific definition, occupations possess distinct characteristics that contribute to a comprehensive understanding of the concept. Primarily, occupations can encompass various types of knowledge that extend beyond typical skill definitions, including technical, abstract, procedural, and inferential knowledge (Standing, 2009). Secondly, occupations may claim certain entitlements such as monopolising practice, the authority to establish work guidelines for practitioners, and the ability to govern and oversee training, recruitment, and licensure. The third characteristic involves the heterogeneity of occupations, with variations based on tasks or specialisations, contributing to insights into labour division and the exertion of power by those occupying these roles (Blum et al., 1988).

Standing (2009) suggested that occupations should be seen as transient because they are temporary constructs that emerge and collapse over time, as some of the occupations existing today did not exist at some point and vice versa. Freidson (1985) highlighted that social and economic constraints have an influence on the way occupations appear or disappear. As an example, Treggari (1980) proposed that the occupation of a plumber emerged due to the growing complexity of technology, requiring trained professionals. Previously, individuals without training carried out closely related tasks such as bricklaying or plumbing. This inherent instability means occupations more broadly contend with internal and external pressures, engaging with other societal and economic interests. This dynamic enables occupational groups to distinguish themselves from others (Blum et al., 1988), enabling the emergence or decline of occupations. Building on this, Hughes (1958) posited that new occupations gain formalisation through specialised training and credentialing processes.

2.2 Origins of occupations

Abbot (1989) presented two ancestries in the genesis of occupations. The Hughesian narrative emphasises ecological institutionalism and social psychology. The latter examined spatial distributions and functional roles of individuals engaged in diverse work (Shils, 1996). Ecological institutionalism literature primarily addresses professions, while social psychology is concerned with job satisfaction. In this study, the focus is on the Hughesian perspective concerning the origins of occupations, that is, the ecological institutionalism story.

Hughesian ideas formed the earlier understanding of occupational structuring and provided three origins of new occupations, including new social institutions, technical developments, and social movements. In any of the three origins, occupations can either naturally emerge or artificially be formed aided by the state (Kuhlmann, 2013; Standing, 2009). Social institutions and technological advancements often facilitate the emergence of occupations. In the United States (US), the expansion of complex organisational structures in sectors like healthcare, education, and social services, alongside increased governmental involvement, reshaped existing work roles and facilitated the creation of entirely new occupations (Wyatt, 2006).

Wyatt (2006) further indicated that technological advancement led to new specialisations and occupations, especially for technical workers, such as computer specialists, who did not exist until the 1950s. New technical roles in the United States (US) reportedly grew fourfold between 1910 and 2000 in the education, social services, and healthcare sectors. Crosby (2002) contended that apart from technological progress, legal changes and societal shifts, particularly within the business realm, contribute to the emergence of new occupations. Such changes necessitate workers acquire fresh skills to effectively engage in the new tasks linked to these shifts. Cosby (2002) indicated that institutions like welfare-to-work in the United States prompted the need for criminal laws and new job types, such as human services workers, leading to new occupations like restitution specialists and children's advocates.

In some cases, occupations emerge from work that "formerly was performed by amateurs, or for pay by people with little or no formal training" (Hughes, 1958, p.133). For instance, the expansion of demand for labour in higher-earning new occupations led to the disruption of agricultural occupations in the United States, enticing workers to transition away from farming (Wyatt, 2006). This observation aligns with Hughes's (1958) assertion that new occupations often recruit individuals from existing occupational spheres. This phenomenon was not exclusive to the United States; comparable occurrences occurred in regions like the United Kingdom and other parts of Europe, where certain agricultural occupations were phased out due to technological advancements.

Over time, informal occupations tend to evolve towards formalisation, incorporating training and credentialing, which solidifies them as distinct governing entities with well-defined boundaries (Hughes, 1958). Consequently, this formalisation process can lead to both social and occupational exclusions, as individuals with specialised training and knowledge reinforce occupational boundaries, thus exacerbating inequalities in the labour market and society at

large (Blum et al., 1988; Kuhlmann, 2013). As mentioned earlier, governments significantly influence the structuring of occupations, contributing to the emergence or decline of specific occupations, a topic briefly explored in the following section.

2.3 The role of the state in the emergence and functioning of occupations

Existing literature indicates that the emergence of occupations can be influenced by political forces and structural dynamics. Kuhlmann (2013) argued that governmentality plays a role in the development of occupations by professionalising specialised knowledge. He contended that in some instances, the neutrality of professional expertise is an “outcome of the political process rather than an outcome of inherent essence” (p. 9).

In the historical context, the influence of governments on the structuring and regulation of occupations became more pronounced after the Second World War, particularly in the early 1950s (Abbott, 2010). This era marked a shift toward governmental intervention in work structures, leading to the establishment of controlling hierarchies that influenced changes in labour mobility and employment levels. This period also saw the emergence of hierarchical organisation within occupations, exemplified by the publication of the American Occupational Structure in the 1960s.

According to Abbott (1993), by assuming well-defined and artificially constructed occupations with well-defined statuses, these new stratification analyses negated the ecological and processual approach to occupations and work, only allowing for demographic movement within a fixed structure.

Standing (2009) emphasised the role of states in shaping the emergence and disintegration of occupations. He pointed out that governments at times safeguard specific occupations for the middle class. Across various nations, state intervention in occupational regulation and decommodification has eroded or eliminated many distinctive aspects that once characterised occupations. The UK government, for instance, pursued labour flexibility and criticised restrictive labour practices for workers (Standing, 2009). The government also controlled the jurisdiction of the occupational market by insisting that market interests prevail. It enacted the Legal Services Act to allow both non-lawyers and lawyers to set up businesses to provide consumers with legal services (Standing, 2009).

The state's influence on occupations also extends to diminishing their collective power by allowing for the disruption of inter-occupational collaborations. For instance, in the United States, the Supreme Court and Federal Trade Commission intervened to hinder inter-occupational partnerships, preventing professionals from establishing occupational regulations (Spangler, 1986). State regulation of occupational activities compels corporations to seek alternative ways of conducting work through professions, bypassing reliance on traditional occupations. This phenomenon has been observed in the United Kingdom and other countries, where corporations have commercialised occupations by restructuring and transforming professions into lucrative enterprises, thus weakening the impact of heavily regulated occupations (Standing, 2009). Literature also shows that governments can significantly curtail the influence of occupation over regulating labour power, a realm over which occupations traditionally held authority. In the 1930s, as Spangler (1986) contended, occupations exercised control over the labour supply by dictating eligibility criteria and curricula, constraining access to training institutions, and governing exit pathways. This authority allowed occupations to limit the influx of individuals entering the profession.

Nevertheless, this authority has waned in the wake of neoliberalism, which advocates that some occupations lose control over the supply of people practising in occupations (Krause, 1996). Governments have increasingly restructured training and education system to weaken occupational control of knowledge by giving universities the power to determine the curriculum contents and design (Abbott, 1988). Weakening the occupational capacity to control knowledge ultimately leads to some occupations disintegrating. Once an occupation loses control over knowledge, it becomes vulnerable to "being split into less defensible fragments" (Standing, 2009, p.165). The 'fragments' may be new occupations or specialisations under the same occupation. Spangler (1986) pointed out that standardising knowledge can lead to the erosion of professional expertise, leaving an occupation vulnerable to attacks in other aspects. This commodification gradually absorbs occupational expertise, resulting in deskilling (Abbott, 1988). Occupations serve as the principal mechanisms for skills planning and development across numerous countries. Their evolutionary trajectory is elaborated upon in the subsequent section.

2.4 A historical sociology of occupations

The history of how occupations emerged is long. It dates back centuries in many parts of the world, from pre-industrial to feudal medieval societies and the Industrial Revolution eras. However, documented history of occupations extends back to the medieval period, characterised by the presence of occupational guilds encompassing diverse fields, including trades, artisans, and merchants (Ogilvie, 2014). A guild broadly consisted of an association of people with similar characteristics pursuing a mutual purpose (Ogilvie, 2014). Although guilds existed in many parts of the world, including ancient Egypt, Rome, Latin America, and 19th-century China, it was in medieval Europe where economic guilds formed around occupations (Ogilvie, 2007; Richardson, 2004). Historical guilds were organised around social, religious, people of foreign origin and commercial circles but were popularly formed around shared occupations, although their members would engage in social and religious activities (Ogilvie, 2014; Richardson, 2004).

Between the years 1000 and 1800, occupational guilds gained prominence in numerous parts of medieval Europe, notably in countries like England, Belgium, Germany, France, and Italy, as well as in the Dutch and Baltic cities and various smaller towns (Caracausi, 2016; Lindberg, 2010; Ogilvie, 2014, 2007). These guilds, typically commercial in nature, consisted predominantly of merchants and craftsmen dedicated to specific trades (Epstein, 2008; Ogilvie, 2014). In regions like Italy, while the guilds initially brought together tradespeople and merchants under one umbrella, by the 19th century, distinct guilds for local traders, craftsmen, and long-distance merchants had emerged across the continent (Epstein, 2008). Examples of these professions spanned across lacemaking, weaving, ironwork, fishing, and linen weaving, to name a few (Davids, 2008; Ogilvie, 2007; Walker, 1998). While agriculture was a widespread practice, it was not structured as a distinct occupation. To operate within their trades, craftsmen and merchants often needed to procure licenses from the pertinent guilds, but some regions, notably guild-free towns and enclaves, allowed craftsmen and traders to function outside the governance of any guild (Caracausi, 2016). Interestingly, these guilds not only birthed new occupations but also bolstered their own presence, often leading to the dissolution of rival occupations. They achieved this through tactics reminiscent of modern occupational strategies: guarding against external competition, enhancing members' skill sets, and petitioning local and state authorities to impose regulations on other occupations. In the subsequent sections, I present the specific measures occupational guilds employed that influenced the emergence or dissolution of occupations.

Protection against competition

During the medieval period, guilds were pivotal in safeguarding their trades and professions from competitors by exercising control over the market and their memberships. By restricting apprenticeships and barring specific groups like women (except for widows of past guild masters), Jews, religious minorities, former serfs, and slaves from entry, they maintained exclusivity within their ranks (Davids, 2008; Hafter, 2007; Ogilvie, 2007). Members of these guilds enjoyed exclusive rights in their trade, sometimes to the extent of having monopolistic control over vital production inputs. For instance, weaver guilds granted members the sole right to produce specific fabrics, ensuring they were the only sellers of such products. Similarly, certain merchant guilds had exclusive rights to procure specific raw materials and hire personnel for their trades (La Force, 1965).

To counter the influence of urban guilds, rural artisans established their own guilds, ensuring they had a platform to protect their interests against their urban counterparts (Boldorf, 2009; Lindberg, 2009; Ogilvie, 2011). Moreover, these medieval guilds set quality standards for goods and services. Craftsmen guilds, for example, strictly regulated material quality, training, and production methods to retain their unique positioning and control in the market (Lindberg, 2010). To defend their monopolies, guilds adopted a series of restrictive practices, such as trade volume caps, price setting above market rates, imposing costs on competitors, and restricting migration (Boldorf, 2009; La Force, 1965).

To ensure the preservation of the guild's exclusivity and status, hefty membership fees were levied on prospective members who met entry criteria. Larmour (1967) highlighted that a journeyman had to pay an amount equal to nearly nine years of his wages to attain the title of a master within a guild. Such market regulations and entry restrictions were strategically designed to shield established guild occupations from newer, emerging trades.

Occupational skills development

In the medieval skills ecosystem, guilds often played a crucial role in ensuring specialised skills development and training within their specific occupations. To maintain their unique stature and superiority, guilds imparted specialised training to their members, emphasising the invention and adoption of superior techniques (Ogilvie, 2014). There were essential skills, such as literacy, language proficiency, and numeracy, that some guilds deemed mandatory (Boldorf, 2009). Artisan guilds, in particular, often imposed stringent training demands on their

members, incorporating both formal training programmes and apprenticeships. Apprenticeships typically entailed a specified duration of unpaid or minimally paid hands-on training under the guidance of a guild master. Beyond apprenticeships, journeymanhood was another phase where the craftsman, while earning a nominal wage, would serve under a guild master, often necessitating travel from one town to another (Epstein, 2008).

To progress from an apprentice or journeyman to a master, certain guilds necessitated passing examinations or the creation of a ‘masterpiece’ – a tangible testament to the artisan’s skill. Only those who attained the title of a ‘master’ and secured the requisite license were permitted to independently practise their trade (Ogilvie, 2014). This structure reveals a sophisticated skills development ecosystem operated by occupational guilds during this era. Drawing a parallel to contemporary skill development models, the guild masters epitomised leadership in the skills ecosystem. In tandem, while local and state governments facilitated overarching structures or verticalities, the various guild members, whether craftsmen or merchants, fostered collaborative networks or horizontalities.

Lobbying local and state governments to regulate occupations

During medieval times, occupational guilds safeguarded the occupations under their purview and actively influenced the inception and regulation of competing occupations. This was primarily achieved by seeking government intervention at both local and state levels. Governments, often under the influence of these guilds, would enact legislation that favoured the guilds, thereby shielding their occupations from potential competition and obstructing innovations that could jeopardise their monopoly (Epstein, 2008). Substantial lobbying efforts on the part of the guilds fuelled the deep entanglement between guilds and political powers. For example, the considerable amount expended by the German weavers’ guild on political lobbying, equivalent to 115 days of a guild master’s wages, underscores their vested interest in acquiring political patronage (Larmour, 1967).

Furthermore, governments often officially sanctioned and bolstered the privileges of these guilds through formal charters. These charters delineated the rights and entitlements of various guilds, although at times, guilds would assert privileges not explicitly mentioned in the charters, operating on tradition and perceived entitlements. Understandably, such overreaches resulted in conflicts among guilds, between guilds from various towns, or between guilded groups and unguilded outsiders (Hafer, 2007; Lindberg, 2009; Van den Heuvel, 2007). It is

evident that the role of local and state governments was paramount in shaping the landscape of occupations by directly controlling economic activities and indirectly influencing the creation and dynamics of occupational guilds.

Referring to Chapter 3 of this thesis, which discusses the theoretical framework, it is discernible that institutions like governments, which sit in rule-producing activity systems, act as vertical facilitators within the skills ecosystem. The pivotal role of local and state governments in establishing rules and policies was evidently influential in the functioning and governance of these medieval occupational guilds.

2.4.1 The decline of occupational guilds

The decline of occupational guilds in Europe, particularly by the 1600s, was precipitated by a combination of internal factors, external pressures, and historical developments. As regions like England and the Low Countries underwent significant socio-economic shifts, non-guilded groups, including rural artisans and traders, gained prominence as entrepreneurial forces (Ehmer, 2008; Harreld, 2004). State interventions also played a part: the Norwegian crown moved against the German Hansa in 1400, and England's Crown Reformation between the 1530s and 1540s regulated guilds, often seizing their assets (Ehmer, 2008; Lindberg, 2010; La Force, 1965). Amsterdam, a European trade behemoth, ousted textile and merchant guilds, while areas like Flanders encouraged non-guilded competition by establishing rural industrial zones (Davids, 2008; Ehmer, 2008; La Force, 1965; Ogilvie, 2011).

However, in places like France and Spain, guilds retained influence until the 1800s by effectively lobbying political leaders and diverting significant portions of their revenue to state coffers (Ogilvie, 2014). However, the advent of the Industrial Revolution marked the guilds' irrevocable decline. While they had historically resisted innovations, fearing obsolescence, the overwhelming technological advancements of the era rendered their opposition moot (Davids, 2008; Ogilvie, 2014). With increased competition and rapid technological evolution, guilds faced extinction or amalgamated into growing industries. Thus, the Industrial Revolution, which favoured large-scale industries over small artisanal occupations, further accelerated the decline of the guilds (Crowston & Lemercier, 2019).

The historical trajectory of these occupational guilds provides a rich tapestry of insights into the socio-economic dynamics of various European societies, each with its distinct linguistic,

social, and skill structures (Ogilvie, 2014). These lessons serve as valuable precedents when analysing the occupational evolution in African nations, as explored in the following sections.

2.5 Occupational discourse transferred into African skills planning systems

The occupational discourse was transferred into African skills planning systems during colonialism following the 17th-century Industrial Revolution. While the Industrial Revolution played a role in the decline of occupational guilds, their fundamental concepts found their place in mainstream skills planning systems during that period and later extended to Africa during the colonial era. The Industrial Revolution, characterised by technological advancements that mechanised human labour, notably in Britain and other European regions, led to the disruption and restructuring of work processes, resulting in the emergence of new occupations (Crafts, 2011). Technological advancements introduced novel production processes that were absent in pre-industrial feudal or medieval societies. This restructuring of work, labour processes, and economic relationships marked a significant transformation (Volti, 2008). The disruptions caused by the Industrial Revolution resulted in a shift from independent artisans to dependent wage labourers. This transformation led to the development of new skills required to operate emerging large enterprises that had not previously existed (Lindert, 1980). Industries like meat packing, refineries, and steel mills demanded skills distinct from traditional agricultural practices (Lindert, 1980).

Consequently, the emergence of these new occupations prompted the establishment of new and structured ways to categorise them with professional standards and qualification or training requirements, including occupational tables by Masse (from the 1750s) and Patrick Colquhoun (1800s) (Lindert, 1980). The acquisition of new skills during this period led to the need for educational programmes. Mass education initiatives, particularly targeting the middle and upper classes, gained momentum during the Industrial Revolution, reminiscent of a key aspect observed in occupational guilds. As pointed out by Mitch (2018), a significant proportion of the English workforce (approximately 72%) was engaged in entirely new skilled occupations that emerged as a result of the industrial transformation.

Between 1800 and 1900, during the peak of the Second Industrial Revolution, European imperialism was unfolding across various global regions, including Africa. This period witnessed the dissemination of Industrial Revolution concepts and the adoption of agricultural technologies, prevalent in Europe, to new territories within Sub-Saharan Africa (Mackenzie,

2005). Because agriculture was the dominant mainstay in most African states, agricultural transformation presented the best opportunity from both the African and colonial perspectives. The assumption was that all innovations were helpful to farmers, irrespective of their economic, social, or cultural orientation. New changes started to crop in, such as imposing European-style freeholding and land ownership to replace communal tenure under traditional authorities (Mamdani, 1996). African communal and subsistence farmers were encouraged to adopt new technologies and practices to improve their production for export to colonial countries (Mukembo & Edwards, 2015).

The development of agricultural extension services gained momentum in African colonies due to the increasing demand for commodity exports, coinciding with the height of the Industrial Revolution. During this period, the prevailing extension models were top-down in nature, with farmers having minimal input and their knowledge and perspectives receiving little consideration (Mukembo & Edwards, 2015). Anderson (2006) stated that a centre-periphery extension model was employed with coercion tactics if farmers resisted adopting new practices. This extension approach gained significant traction in British and French colonies, where the governance of extension systems was centralised, and public responsiveness was tightly controlled and directed (Mukembo & Edwards, 2015). Consequently, colonial powers found it advantageous to introduce new farming innovations and extension services to enhance agricultural practices, particularly after the partitioning of Africa (Jones & Garforth, 1997).

Prior to 1914, societies in Sub-Saharan Africa predominantly relied on indigenous farming methods, encompassing practices such as transhumance and various artisan occupations (Bessong, 2000). However, the onset of colonial rule brought about a significant shift, as colonial powers aimed to alter and impose European systems of vocational education, administrative structures, agriculture, and land tenure within these regions (Bonnin & Ruggunan, 2016). This era saw collaborative efforts between colonial administration bodies and missionary groups, leading to the provision of agricultural extension services in colonies like the Belgian Congo. This interaction intensified after Africa's scramble and partition, and agricultural departments and missionary centres spearheaded the introduction of agricultural extension by introducing improved cultivation practices to shift African communities from indigenous agricultural practices (Jones & Garforth, 1997; Willis, 1992). From 1914 onwards, numerous British colonies had established agricultural departments, notably in countries such

as South Africa and Kenya, signalling a significant stride in advancing agricultural extension services within the colonial context (Mukembo & Edwards, 2015).

Bessong (2000) highlights that while European explorers, traders, and missionaries had diverse motivations for their presence in Africa, including knowledge acquisition and spreading Christianity, it is clear that colonialism significantly impacted Africans' perceptions of particular professions and occupations. This influence has persisted, shaping career development, educational aspirations, and occupational choices among Africans to this day. In the early stages of colonialism, alongside agricultural extension, new occupations emerged, with Africans taking on roles such as clerks, interpreters, and eventually administrative officers (McClendon, 2006). As education and skills training expanded in Africa, colonialism began to emphasise specific occupations and professions like lawyers, medicine, and teaching. However, Europeans predominantly held these positions, often relegating Africans to manual labour roles (Mbaku, 1997).

Towards independence in the African states, colonial governments started to introduce formal extension education. This was implemented through vocational education, hoping to facilitate economic development in independent African states (briefly discussed in Chapter 1, section 1.2).

In agriculture particularly, many Africans embraced colonial education and believed in its efficacy as a way of escaping strenuous and unremunerative peasant work (Wood, 1974). However, in certain Sub-Saharan African countries, colonial rule-imposed limitations on education and career options. For example, in South Africa, Mathabe and Temane (1993) noted that the Vocational Educational Act No. 70 of 1955 prohibited indigenous Africans from enrolling in technical colleges. In extension, Coetzee (1987) highlighted the discriminatory practice in South Africa, where education for extensionists was provided only to Whites, primarily to serve White farmers, as Chapter 5 (section 5.2.1) elaborates. In other Sub-Saharan African nations like Cameroon, European colonialists introduced plantation agriculture along coastal regions, leading to the development of trading and agricultural occupations, which attracted a large unskilled labour force (DeLancey, 1989). In some instances, colonial administrations offered educational opportunities to the children of farm workers to study agricultural professions abroad to have them return to assume agricultural positions (Bessong, 2000). In the following section, I discuss how occupations emerged to become a significant feature of skills planning in African countries.

2.5.1 Occupations as a key feature of skills planning in African countries

Like elsewhere, African countries use occupations and occupational classification systems for various purposes, such as measuring occupational performance, monitoring the labour market, and facilitating qualification and curricula design (Shalem & Allais, 2018). In their current form, occupations are primary units of intervention for skills planning and development. Shalem and Alias (2018, p. 2) stated that labour markets in many countries are organised and controlled by occupations, affecting skills training and education because this indicates the “relationship between an occupation and knowledge”.

Globalisation has spurred the internationalisation of work and knowledge, prompting nations to structure work and occupations into standardised systems for cross-border comparisons. The International Labour Organisation (ILO) played a significant role in this process by introducing the International Standard Classification of Occupations (ISCO), a coded framework designed for global occupational classification. The ILO was prompted to develop the ISCO by the growing need for labour market data on occupations that could be compared internationally (ILO, 2008). Several African countries, South Africa included, have customised the International Standard Classification of Occupations (ISCO) to create their own coded occupational classification system known as the Organising Framework for Occupations (OFO) (refer to Chapter 5). The OFO, adapted from ISCO, has undergone slight modifications to align with local labour circumstances (OFO, 2013). Moreover, the South African Public Service has created its distinct Occupational Classification System (OCS), is employed in conjunction with the OFO. In Nigeria, the National Board for Technical Education (NBTE) has formulated the National Occupational Standards, a classification framework TVET colleges utilise for curriculum design (NBTE, n.d.).

These structured occupational frameworks are gaining prominence in shaping educational qualifications and occupational information for skills planning across various educational levels, ranging from primary and secondary schools to colleges and universities. This process aids in equipping the workforce with the necessary skills for local and international employment opportunities (Gamble, 2022). In Nigeria, Ayo and Okifo (2021) emphasised that occupations are crucial in guiding students and graduates in making informed career choices aligned with the available opportunities within their local communities. Additionally, Brown and Hollis (2013) highlighted that occupational information aids individuals in comprehending

the necessary skills and competencies for better preparedness, thereby mitigating job dissatisfaction and ultimately enhancing productivity.

Occupations in Africa also act as a mechanism for local labour recruitment, as indicated in the empirical finding sections of Chapter 5 and Chapter 6, attracting and retaining foreign skilled labour and continuous professional development (Ntuli & Gwatidzo, 2013). In South Africa, the Department of Higher Education and Training (DHET) has formulated a list³ of hard-to-fill vacancies and scarce skills occupations. These designations are utilised by the Department of Home Affairs to facilitate the recruitment of skilled foreign labour, aligning with the country's workforce needs (see Chapter 5, section 5.6.2). In contrast, some countries, such as Uganda, have adopted the ISCO-2008 framework without significant contextual modifications. The Uganda Bureau of Statistics (UBOS) employs the ISCO-2008 framework directly within the local context for occupational classification (UBOS, 2016) (see Chapter 6, section 6.7.2). As highlighted by Ramsarup (2020), occupations continue to play a crucial role in resource allocation, skills planning, and monitoring and evaluation processes despite their inherent limitations. This significance is evident in their widespread use for skills planning across Africa. In the subsequent section, the focus will shift to examining the nature of the extension officer occupation within the African context.

2.6 The nature of extension officer occupation in Africa

The role of extension services in Africa is paramount, especially in facilitating rural development. According to Abdu-Raheem and Worth (2016), the primary beneficiaries of agricultural extension services are small-scale and smallholder farmers (majority women), who collectively represent the vast majority of the smallholder farming community in Africa. Extension agents provide these farmers with the necessary information, technical advice and other services such as farm inputs. Extension agents' significance as primary information disseminators to smallholder farmers in Africa is consistently emphasised in scholarly research. For instance, Adegboye et al. (2013) highlighted their trustworthiness in Nigeria as key agricultural informants among farming communities.

Similarly, Afful and Lategan (2014) underscored the popularity and necessity of public extension services among South Africa's smallholder farmers. These findings across diverse

³ See the list of scarce skills occupations used by the Department of Home Affairs – www.dha.gov.za/images/PDFs/47182-2-8-CriticalSkillsDHA.pdf

African settings emphasise the integral role of extension agents in the continent's agricultural development. In fact, the InterAcademy Council (2004) postulated that economic stagnation observed in several African nations could be symptomatic of an underperforming agricultural sector given agriculture's contribution to African countries' economic development.

Historically, government entities were the predominant providers of extension services in most African countries. These services, staffed by extension instructors, primarily focused on sharing agricultural information and encouraging farmers to embrace new technologies (Adolph, 2011). Additionally, extension encompassed other pivotal roles, such as distributing farm inputs and ensuring water supply to smallholder farmers.

During the 1980s and 90s, agricultural extension in Africa underwent significant shifts. As many African states embraced World Bank-backed structural adjustments and market-centric development models, direct governmental support for public extension waned (Mutimba, 2014). These changes encompassed privatisation, democratisation, economic liberalisation, and decentralisation, targeting improved service delivery (Muriisa, 2008). Services like subsidised credit and publicly financed marketing boards, once provided by public extension, were either drastically scaled back or eliminated entirely. This significantly reduced the impact of extension services on the agricultural sector, mainly for smallholder farmers heavily relying on it. The decline in public extension support created a considerable gap, prompting private extension systems to emerge (Mphepo & Urassa, 2022; Mutimba, 2014).

As a result of declining public extension support, African governments fostered a pluralistic extension approach, paving the way for a diverse range of providers. This included profit-driven entities such as agrochemical companies, contract growers, and non-profit entities such as non-governmental organisations (Mutimba, 2014). In Uganda, for instance, the decentralisation process was initiated in 1986 by the newly established democratic government, the National Resistance Movement. This reform aimed to foster local involvement in various developmental projects, including extension services (Muriisa, 2008). In some other countries such as Rwanda, Uganda, Botswana, and Tanzania, agricultural extension has since been implemented locally by district agricultural departments and with limited involvement of line Ministries (Mphepo & Urassa, 2022; Muriisa, 2008). To comprehensively grasp the nature of the extension occupation in Africa, it is crucial to carefully examine its various dimensions. In

the following sub-sections, I further explain critical descriptions of extension in Sub-Saharan Africa.

2.6.1 Organisation of extension

As earlier mentioned in the above section, traditionally, extension inherited from colonial era was centralised and government led. From the 1980s, the advent of World Bank-backed structural adjustments in Africa prompted a restructuring in the way extension services were delivered, driving many governments towards a decentralised and pluralistic approach (Stringfellow et al., 1997). In this context, numerous African nations have adopted a decentralised extension service delivery, with the duty of supervision and role delegation resting with the Ministries or Departments of Agriculture. At its core, decentralisation entails the shift of extension delivery responsibilities to more localised tiers of governance, such as district or county administrations (Abdu-Raheem & Worth, 2016). Expounding on this, Davis and Terblanche (2016, p. 235) categorised decentralisation into four distinct types: de-concentration, delegation, devolution, and transfer to non-governmental entities. In the African context, the predominant decentralisation forms are privatisation, which involves transferring responsibilities to non-government institutions, and the ministry-based approach. The latter sees the central government retaining control and financing but re-delegating execution responsibilities to more localised governmental units (Abdu-Raheem & Worth, 2016). However, this ministry-based approach is not without its challenges. Anderson and Feder (2004) criticised it for its financial unsustainability and its inefficiency in establishing strong links with research.

In various African countries, there has been a noticeable trend towards decentralising extension services, often accompanied by a shift towards privatisation, with the government's role ranging from complete withdrawal to more measured approaches like commercialisation and cost-sharing. This shift manifests as commercial aspects like selling publications, farm inputs, and even contracting private entities to deliver public services (Kidd et al., 2000). Such a move is often praised for its potential to reduce the financial strain typically borne by the public sector (Anderson & Feder, 2004). While there are certain drawbacks to this approach, the Global Forum for Rural Advisory Services [GFRAS] (2012) contends that when executed effectively, decentralisation can bolster accountability to the primary beneficiaries-the rural smallholder

farmers. This is achieved by delegating responsibilities to frontline extension agents, those who interact directly and frequently with the farming community.

Decentralisation in African extension services has created a pluralistic model that is pivotal for contemporary agricultural evolution. This inclination towards pluralism is driven by its inherent qualities of being participatory and demand-driven, actively involving entities from the public, private, and civil sectors (Pye-Smith, 2012; Qamar, 2005). Such a model, championed by scholars like Eicher (2007), signifies a broader scope of service providers entering the extension landscape. This influx from private and non-profit sectors has expanded the traditional functions of extension services. Beyond the usual dissemination of information and knowledge, extension now encompasses a range of services, from supplying agricultural inputs, fostering skills in natural resources management, facilitating rural credit, and endorsing entrepreneurial activities and livestock management (Dugle et al., 2015). Using Ghana as an example, the involvement of NGOs in agricultural extension has been evident since the 1990s, with a specific focus on project-based rural development initiatives (Dugle et al., 2015). Eicher (2007, p.5) asserted that the amalgamation of public sectors, NGOs, and private firms catering to the extension needs of smallholders is not simply a trend in a few countries but is evident almost universally in the developing world.

While this diversity is advantageous, it has challenges. Coordinating these multiple service providers to avoid service duplication and to ensure the vulnerable farming community receives the necessary assistance poses governance issues (Christoplos, 2010). The challenge of harmonising the efforts of these varied stakeholders emphasises the significance of this study's adoption of the Social Ecosystems Model (SEM) for skills, which will be elaborated upon in Chapter 3 and discussed in Chapter 7. Despite the governance and coordination challenges, the involvement of a broad spectrum of players in the extension landscape is celebrated for its potential to drive innovation and technological development in agriculture. Swanson (2008) anticipated that private enterprises would largely shape the future of agricultural extension technology, leading to a dominant role for these firms in the technology transfer process. He further predicted that there would likely be a reduction in the number of government front-line agents in extension due to public-private partnerships, mainly in developing countries. To prepare for this uncertain future of extension, there is a need for collaborative planning, implementation, and evaluation of projects by service providers and to create effective linkages between research, extension and other relevant actors and institutions,

as Qamar (2005) emphasised, especially to ensure inclusion of smallholder farmers (Lotz-Sisitka et al., 2018).

2.6.2 Extension approaches

As mentioned earlier, in numerous African nations, the landscape of agricultural extension reflects a shift towards pluralism regarding who provides the services and how these services are rendered. This pluralistic evolution has fostered the creation of context-tailored extension approaches, resonating with evolving scenarios that demand innovative solutions in agriculture. Abdu-Raheem and Worth (2016) note that West Africa is a testament to this transformation. Here, the prevailing public sector-driven, decentralised pluralistic extension methodologies are undergoing swift changes, paving the way for increased involvement from private entities and other non-state players in extension service delivery. Lotz-Sisitka et al. (2015), however, warn that privatisation of extension services can lead to exclusion of smallholder farmers who are unable to pay for such services.

Agricultural extension models have witnessed various evolutionary phases over time. Röling (1988, p.25) identifies three primary models: the top-down ‘dissemination model’, the bottom-up ‘problem-solving model’, and the ‘social interaction model’. The diffusion model occurs when an innovation spreads from one unit to another from the point of introduction in a social system (Scoones, Thompson & Chamber, 2008). For instance, the use of progressive model farmers as early adopters and as initial points of introducing innovation for other farmers to emulate is recognised as an indirect autonomous diffusion process. The critics of this model suggest that innovation is introduced as a uniform package, and the adopters are not expected to modify it (Leonard-Barton & Rogers, 1981). The second criticism is that this model targeted areas of least resistance through model farmers, ignoring those who needed support the most and lacking attention to structural variables (Scoones et al., 2008). Moreover, the model was ineffective in establishing contextual differences between potential adopters and did not consider other factors, such as the lack of resources or the inapplicability of innovations in some contexts (Röling, 1988).

Another approach is the Farming Systems Research, which is based on the marketing research concept to ensure that only products needed by farmers are developed (Röling, 1988). The third, the social interaction extension approach, focused not on extension agents but on farmers to build their capacity to demand what they needed from extension service providers. The social

interaction model of extension is still prevalent in Africa and has transformed into the Farmer Field School (FFS). Abdu-Raheem and Worth (2016) state that most countries still use the FFS approach to deliver extension services, which is a participatory community-based learning whose motive is to develop field school participants into experts and effective self-teaching experimenters and trainers of farmers and extension workers (Davis, Ekboir & Spielman, 2008; Wiebers, 1993).

GFRAS suggests adopting the best-fit extension approach which involves embracing contemporary pluralistic extension delivery approaches that align with the Agricultural Innovation System (AIS) (GFRAS, 2012). The AIS has led to a shift from a supply-driven model to a demand-driven system to meet the current agricultural demands of farmers and other concerns of end-users (Wambura et al., 2015). The AIS system was proposed because farmers were reluctant to adopt innovations. This system is also credited for its potential to meet the farmers' demands and upon its introduction, it was quickly accepted by civil society and consumers at its inception (Christoplos, 2010; Wambura et al., 2015). Due to its permeation, many African countries have adopted country-specific AIS to foster a pluralistic extension environment. Uganda exemplifies through its policy framework that integrates various public and non-state actors, addressing the fragmented agricultural landscape. By prioritising linkages, institutions, and policy, these efforts aim to provide tailored, effective agricultural services that meet each nation's unique demands and contexts, enhancing the overall efficiency of agricultural extension delivery (MAAIF, 2018).

Agricultural extension in Africa has also witnessed a significant shift towards integrating ICT-based approaches, especially since 2007. Mobile applications have emerged as pivotal tools, offering farmers critical information on market dynamics, weather patterns, and other essential aspects through SMS and the Internet (Abdu-Raheem & Worth, 2016; Aker, 2011). While the transformative potential of these digital tools is recognised, gauging the effectiveness of public extension in African countries is under-researched (Aker, 2011). Mutimba (2014) observes that assessing the efficacy of digital tools is complicated by the challenge of quantitatively attributing specific interventions to tangible outcomes. However, one notable benefit of ICT-based extension approaches is the improved accountability of extension agents to farmers (Dillon, 2012). The variety in the aforementioned extension approaches underscores the growing favour for pluralism. Davis and Terblanche (2016) stresses that the adoption of a pluralistic extension delivery in Africa is due to the continent's varied agricultural landscape, as no single method can adequately address all situations and needs. Similarly, Birner and

Anderson (2007) hold the pluralistic model of extension delivery in high regard, viewing it as the most promising catalyst for propelling Africa's agricultural development.

2.6.3 Professionalisation of extension services

Agricultural advisors continue to play a crucial role in disseminating information and aiding farmers in adopting new technologies and practices in Africa (Prokopy et al., 2015). Ogunremi et al. (2014) affirmed that at the village level in Africa, extension officers are the most effective source of agricultural information. A study by Okwu and Daudu (2011) revealed that a majority of farmers in Nigeria favour extension agents and model farmers over mass media as sources of agricultural information, though they note extension agents may not be the most cost-effective or far-reaching in terms of coverage. Given their pivotal role, governments in Africa have sought to regulate extension agents to ensure they meet specific standards and possess the necessary qualifications, expertise, and competencies, thereby maintaining service quality and credibility (Shemfe & Oladele, 2018).

This is significant because, in extension, the acceptability of the information and other agricultural recommendations depends on the credibility of the information source (Kakade, 2013). Some studies have reported that the credibility of the information sources affects the rate at which farmers adopt agricultural practices and utilise the information (Dhayal & Bochalya, 2015; Kakade, 2013). Extension agents need to be credible, well-trained and with the right qualifications and understanding of the context for quick acceptance and provision of valuable services to the farmers.

Nevertheless, professionalising the extension occupation in various African countries still faces challenges, notably the absence of adequate accreditation authorities, as highlighted by Shemfe and Oladele (2018). Klazinga (2000) defined accreditation as the process of evaluating an individual's capability to meet the objectives and mission of the accrediting entity following established professional criteria.

Accreditation is integral to the reputation of extension services and agents. The lack of accreditation and a seeming reluctance to regulate service providers has diminished confidence in extension services. Some farmers view some extension agents with suspicion, doubting their reliability as authentic sources of knowledge. This realisation has led many countries to emphasise the importance of having minimum educational qualifications and relevant experience in agricultural extension, as highlighted by Olorunfemi and Oladele (2021). For

example, in South Africa, the stipulated minimum qualification for extension professionals is a Diploma in Agriculture or its equivalent, as findings reveal in Chapter 5, section 5.6.1. Meanwhile, Uganda mandates a Bachelor's degree in agriculture, extension, or a related field for public extension positions. However, private extension service providers are more lenient, accepting a Diploma in Agriculture or a similar discipline, as findings indicate in Chapter 6, section 6.7.1).

Extension agents themselves have shown strong support for the move to professionalise their profession and the occupation. For instance, research by Shemfe and Oladele (2018) revealed that many extension officers support the professionalisation and accreditation of their roles, believing it bolsters farmer trust and ensures better accountability. Nevertheless, some officers voiced concerns about the absence of structured professional development plans within their organisations and felt unsupported in their efforts to achieve accreditation. These findings underscore the importance of continuous professional development. In South Africa, for instance, the Natural Scientific Professions Act (Act No. 27 of 2003) mandates ongoing development for registered extension professionals. This is to ensure they adhere to a code of conduct and constantly update their field knowledge and skills (SASAE, n.d). Additionally, these professionals are implored to enrich the existing body of knowledge in their area of expertise (Davis & Terblanche, 2016).

Unfortunately, research has shown that African extension professionals trail behind other fields in research and knowledge documentation despite the wealth of insights they accumulate in their line of work (Mutimba, 2014). This shortfall is linked to the focus of educational institutions on training extensionists primarily for fieldwork and enhancing livelihoods rather than on research and knowledge contribution (Mutimba & Khaila, 2011).

The existing research gap highlights the necessity for the push towards professionalisation to emphasise competency and the ability for knowledge generation. Taking South Africa as an example, the South African Society for Agricultural Extension (SASAE) is making strides to bridge this gap. SASAE has established an academic journal for research publication, hosts annual conferences, and offers training. Through these initiatives, SASAE ensures that its members continually enhance their skills and make substantial contributions to the discipline's body of knowledge.

2.6.4 Extension policy environment

Policy is a significant aspect of agricultural extension in Africa. The African Forum for Agricultural Advisory Services (AFAAS) plays a central role in shaping agricultural extension policies in Africa, connecting public and private service providers. Present in over 12 countries, including Uganda, South Africa, and Nigeria, it leads policy discussions, fosters professional growth, and strengthens localised extension services. AFAAS focuses on enhancing knowledge adoption and innovation, particularly prioritising the needs of smallholder farmers in the broader extension discourse (AFAAS, n.d.). The organisation aligns with the Comprehensive Africa Agriculture Development Programme (CAADP) goals, targeting a 6% GDP growth as per the African Union's objectives. AFAAS has been instrumental in initiating country-specific extension platforms and organises biennial 'Africa-wide Agricultural Extension Week' events. The 2021 event in Uganda emphasised cultivating effective agricultural extension systems for sustainable agri-preneurship in Africa (AFAAS, n.d. a).

In Sub-Saharan Africa, while many countries have established various country-based extension associations and fora, which have been instrumental in developing extension policy frameworks and contributing to literature, only a handful have enacted formal legislated extension policies. Out of 27 sub-Saharan nations examined by Oladele (2011), only three had operational legislated extension policies. Similarly, Abdu-Raheem and Worth's (2016) study of 17 West African countries revealed that only one had a legislated extension policy in place. The prevailing trend in most African nations is to rely on implied and interim policies, often found in government publications, academic research, development institutions' documentation, and other project reports.

While West African countries have historically emphasised boosting output and agribusiness profitability in their extension missions, challenges persist in their agricultural productivity. Pye-Smith (2012) pinpointed that a primary obstacle to growth in this sector has been the underperformance of extension and advisory services often traced back to insufficient policy-driven financial allocations. Considering evolving challenges, notably those linked to sustainability and climate change, there is a pressing need for African nations to broaden their policy horizons beyond mere productivism.

Qamar (2005) challenged African countries to devise robust national extension policies backed by genuine political intent and actionable commitment. Central to these policies should be the interests and needs of the end-users, primarily the smallholder and small-scale farmers.

Furthermore, it is necessary to re-imagine the role of extension services to equip them to serve their purpose adequately. The subsequent section analyses the multifaceted functions of extension agents and the evolving extension services tailored to the African context.

2.6.5 Functions of extension agents and their skills needs

Shaxson and colleagues (2012) have described the knowledge transfer model of extension delivery that explains the critical functions of extension agents illustrated in Figure 2.1. The model shows different components within knowledge transfer, providing a broad view of extension delivery.

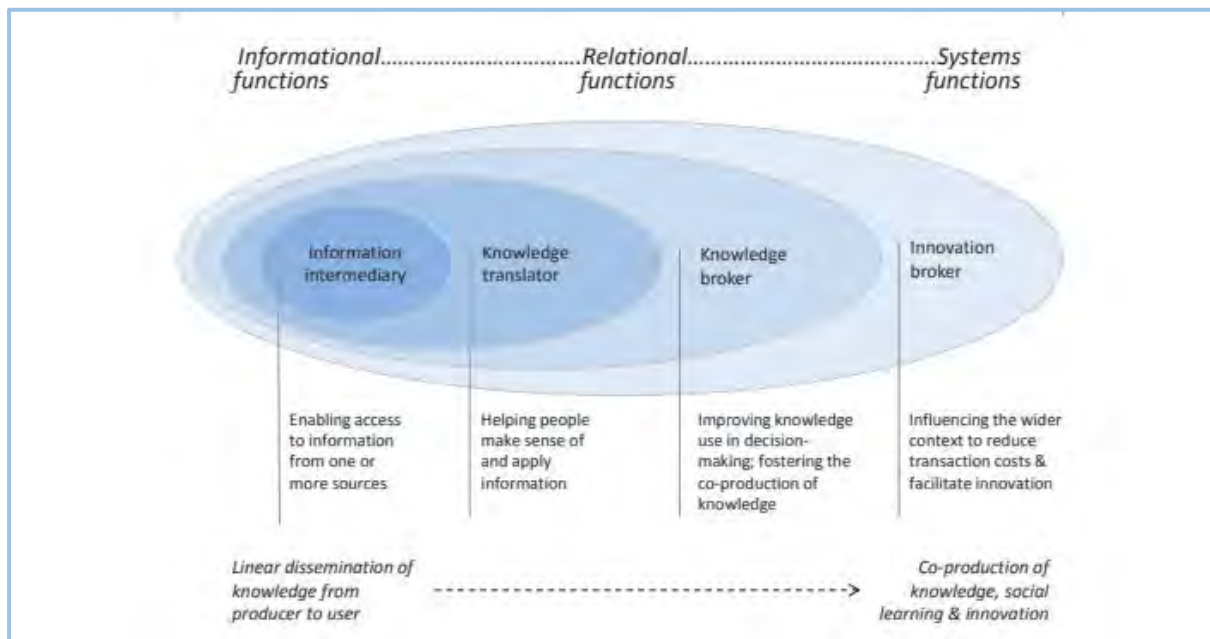


Figure 2.1: Knowledge transfer model

Source: Shaxson et al. (2012, p.13)

Shaxson et al. (2012, p.13) have described extension agents' multifaceted roles and responsibilities in transferring knowledge. Specifically, they identified four key functions that correspond with distinct roles:

1. *Information Intermediaries (Infomediaries)*: These agents play a pivotal role in facilitating access to information. They aggregate, compile, signal, and provide information sourced from various channels. Their main objective is to keep the stakeholders informed and updated.
2. *Knowledge Translators or Knowledge Intermediaries*: Focused on aiding stakeholders in understanding and implementing the information, they are instrumental in disseminating,

translating, and communicating knowledge. A typical activity might include crafting policy briefs that simplify complex information for broader consumption.

3. *Knowledge Brokers*: Their primary aim is to enhance the application of knowledge in decision-making processes. They actively engage in various activities like bridging, connecting, linking, networking, and facilitating. This might manifest in initiatives like knowledge exchange events or expos organised by agricultural departments.

4. *Innovation Brokers*: They work on reshaping contexts to foster innovation. These agents actively negotiate, collaborate, and manage relationships and processes. Their activities often result in creating conducive environments for innovative agricultural practices.

Shaxson et al. (2012) offered several observations regarding the functions of extension actors:

1. *Distinction between Intermediaries and Brokers*: While a person or organisation described as an intermediary is less directly involved in change processes, someone termed as a broker suggests a more direct two-way relationship between knowledge producers and seekers. Notably, a broker does not directly partake in generating or applying knowledge. Instead, they facilitate, helping stakeholders “answer their own questions and function based on the best possible knowledge and information” (Shaxson et al., 2012, p. 14).

2. *Ambiguities and Contextual Variances*: The lines demarcating these functions are not always clear-cut. The terminology to describe these roles can differ based on the sector or the specific context. Moreover, those seeking information typically have a narrower range of activities than those handling the knowledge.

3. *Representation of Functions as Nested Ovals*: Figure 2.1 depicts the functions as a series of interconnected ovals, emphasising their shared objective of enabling access to diverse information sources. This portrayal does not suggest a linear progression among the functions or indicate a hierarchy of importance. It instead illustrates that these functions are interrelated and that aspects of one can be found within the others.

These insights by Shaxson and colleagues elucidate the intricate and overlapping roles of extension actors.

Considering the evolving challenges in the agricultural sector and the broader context of work and living, the importance of extension services cannot be overstated. Foremost among these

challenges is climate change. To address this, extension agents are now tasked with assisting farmers in building capacities in areas like land conservation and managing environmental calamities, all aimed at fostering climate resilience (Leeuwis, 2013; Ozor & Nnaji, 2011). Furthermore, the shift towards market and demand-based rural development posits new roles for extensionists. They now need to bolster trading and demand right at the farm gate, among other responsibilities. However, delivering these extension services is not without challenges. A significant concern is reaching smallholder farmers, particularly women, who often lack access to vital productive resources such as land and capital (Quisumbing & Pandolfelli, 2010).

These challenges demand a reimagined approach to agricultural extension services and require policymakers to channel investments towards strengthening human and social capital. Such efforts would then bolster pro-poor policies tailored explicitly for rural development, with a keen focus on gender equality and climate change (Abdu-Raheem & Worth, 2016). Furthermore, there is an imperative to propel research for development, ensuring alignment with market demands and orientation (Christoplos, 2010). This approach is further augmented by the recommendation to leverage global and regional extension platforms, such as the Global Forum for Rural Advisory Services (GFRAS) and AFAAS, to harmonise efforts across the continent (Davis & Terblanche, 2016). The changing landscape of the agricultural sector necessitates a revision of extension policies and practices. Emphasis should be placed on prioritising smallholder farmers and redefining the role of extension agents to address farmers' current needs and challenges in addition to their current role.

Davis and Terblanche (2016) highlighted that modern extension providers are moving towards having an expanded role beyond traditional outreach. To get there, they need new skills and strategies as they increasingly facilitate and broker relationships within the agricultural innovation system, as emphasised by Davis and Sulaiman (2014).

The significance of an efficient extension system for the progression of agriculture in Africa is largely recognised. Such systems are pivotal in enhancing capacity management for agricultural development, although the exact role varies based on specific contexts (Davis & Terblanche, 2016). Beyond the commonly identified roles of extension agents, Christoplos (2010) delineated a more expansive scope for effective extension systems. This encompasses:

- Dissemination of information on technologies, new research, market trends, and weather updates;

- Offering training and counsel to various stakeholders, including farmers, cooperatives, and agribusinesses within the market value chain;
- Execution of practical on-site trials and adjustment of novel farming techniques;
- Cultivating business acumen among smallholder farmers and local entrepreneurs;
- Bridging gaps between market participants and fostering connections between smallholder farmers, educational institutions, and other key players in the agricultural value chain;
- Elevating awareness of innovative prospects, such as certifications for sustainable and fair-trade practices; and
- Ensuring farmers can access governmental assistance outside the realm of extension.

The diverse roles attributed to extension services suggest a potential revolution in agriculture, particularly benefiting smallholder farmers. However, Pye-Smith (2012) emphasised that the future mandates of extension professionals could be even more expansive. Beyond their traditional responsibilities, extension officers will need to cultivate ‘soft’ skills. These skills will be vital in fostering innovation, bolstering farmer organisation and agribusiness management, and creating alliances and networks amongst a range of stakeholders throughout the agricultural value chain. Table 2.1 draws on Davis and Terblanche (2016) to offer a current view of individual and core competencies required of extension agents and inclusion of climate change responsiveness.

Table 2.1: Individual-level and core competencies required of extension agents

Individual-level competencies		Core competencies (proposed by GFRAS)
Technical competencies	Functional competencies	
Good understanding of appropriate/relevant/new technologies/practices/standards/regulations/policies in agriculture and natural resource management, including: <ul style="list-style-type: none"> • Technical options to support climate change • Adaptation • Agri-business • Value chain development • Improving resource use • Efficiency; application of biotechnology • Intellectual property and farmer rights 	<ul style="list-style-type: none"> • Community mobilisation • Farmer organisational development • Facilitation & Coaching • Reflective learning & Mediating conflict • Negotiating & Brokering • Networking & partnership development • Leadership capacity & Managing resources • Critical thinking & Problem-solving • Self-reflection & Service mindedness 	Understanding of the following; <ul style="list-style-type: none"> • The changing role of extension in innovation and development • Extension programme management • Professional ethics • Adult learning and behaviour change • Communication for innovation • Facilitation for development • Adaptation to change (climate risks) • Gender and youth issues in agricultural extension and rural development • Agricultural entrepreneurship

<ul style="list-style-type: none"> • Use of new information & ICTs 	<ul style="list-style-type: none"> • Accountability and Responsibility • Dedication & teamwork • Working with women & gender sensitivity 	<ul style="list-style-type: none"> • Farmer institutional development
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Source: Adapted from Davis and Terblanche (2016)

Swanson (2008) stated that competencies for extension such as those highlighted in Table 2.1 can be cultivated through continuous education, in-service learning, and on-the-job training. Davis and Terblanche (2016) advocated for incorporating the competencies listed above in Table 2.1 into training curricula designed for extension agents. Davis and Sulaiman (2014) propose that African nations and regions should cultivate the necessary competencies by formulating curricula for vocational and ongoing education, enhancing the skills of extension officers, and periodically revising curricula every five years. They also recommend the establishment of training centres to facilitate capacity building and the enhancement of these competencies.

2.7 Does climate change necessitate new mechanisms for planning skills?

Section 2.5.1 shows that many African countries employ occupation as the primary units of intervention for skills planning and skills development. Advocates assert the significance of occupations by highlighting their role in structuring work, enhancing productivity, and giving members a sense of autonomy and satisfaction (Damarin, 2006; Standing, 2009). Critics, however, deem occupations as obsolete, advocating instead for a more flexible skills approach in anticipation of the evolving work landscape (Shalem & Allais, 2018; Wheelahan & Moodie, 2018) and issues relating to boundaryless careers (Ramsarup, 2020; Tolbert, 1996). This shift, critics argue, is imperative given the emergent challenges in the work environment, which demand a different skill sets and therefore novel mechanisms for planning skills. Shalem and Allais (2018) furthered this notion, suggesting reconsidering our understanding of both occupation and the broader concepts of knowledge and learning, especially in the face of unpredictable career trajectories. Allais (2014), Wheelahan (2010), and Winch (2010) posited that systematic bodies of knowledge and work-based learning are essential components of educational programmes aimed at equipping students for future employment. Wheelahan and Moodie (2018) further highlighted that there is an intrinsic value in preserving “domain-specific knowledge”, which is a cornerstone of professions and occupations. Their assertion underscores the essence of specialisation in learning and knowledge dissemination. Shalem and Allais (2018) emphasised that while the work landscape is undergoing transformation,

providing generic education devoid of specialisation could diminish future employment opportunities for individuals. Moreover, Freidson (2001) opined that possessing an array of skills should not merely translate to a collection of tasks; there should be an innate synergy. Aligning with this perspective, this thesis advocates for reimagining occupation as a mediating unit of analysis for skills planning and the implications it has for skills development in preparation for the changing nature of work and emerging climate-induced challenges because occupations are transient and bureaucratic (Ramsarup, 2020; Standing, 2009), and climate change challenges are requiring new knowledge and flexibility of adaptations across occupations.

Given the literature discovery above regarding the constraints associated with conventional occupational structures, this research seeks to transition from viewing occupations in their traditional, isolated sense. Instead, I seek to consider a more holistic approach that assimilates the interplay between societal, economic, and environmental factors.

Furthermore, the escalating population and its corresponding impact on the environment necessitate a re-imagination of planning systems, including occupations that significantly influence work, learning and living. The ongoing transition from the Holocene to the Anthropocene era, marked by unprecedented environmental and climatic changes due to human activity (Meyer and Newman, 2020), underscores the imperative to rethink our work systems, hence the need for climate resilience skills. This includes rethinking occupations that have traditionally served as mediating units for intervening in skills planning and the implications for skills development.

To deeply examine the challenges surrounding the extension officer occupation, particularly in the context of climate change, this study adopts the Social Ecosystems Model for skills and situates CHAT to theorise its mediation dimension. This theoretical underpinning is further discussed in the subsequent chapter.

2.8 Chapter conclusion

This chapter explored the dynamic concept of occupation, revealing that it has evolved across historical periods and how different scholars conceptualise the concept differently. In summary, for the various definitions, an occupation can be understood as a social category (formal or informal) that encompasses aspects of VET, qualifications and a range of practical and theoretical knowledge needed to perform tasks (related or not) in a particular field of practice. Occupations' emergence are influenced by institutional changes, social constraints,

and technological advancements. The Hughesian perspective helped to critically understand the origins of occupations especially the school of ecological institutionalism. Occupations trace their roots in medieval occupational guilds and the traditional features of occupational guilds can be traced among contemporary occupations such as use of state apparatus to stifle competition and credentialing. This occupational discourse was transferred to African skills systems during colonialism and the Industrial Revolution and this historical connection underscored the role of occupations as primary units of analysis for structuring work, labour, and skills planning and skills development within African contexts. Specific to the extension officer occupation, in Africa, it manifests in a multifaceted nature, and is essential in formulating policy measures, professionalisation development and is significant in rural development. In particular, extension services benefit for women who are majority small-scale farmers. These smallholder farmers face the pressing challenge of climate change which has implications work and livelihoods. Overall, chapter two has foregrounded the urgent need for flexible mediating units for skill planning and development to better navigate the complexities of current and future dynamic work environments in the face of climate change. The chapter further raises the question of whether the occupation is adequate for VET climate resilience skills planning and development. The next chapter considers the theoretical framing of the study.

CHAPTER 3: ELABORATING THE SOCIAL ECOSYSTEM MODEL FOR SKILLS TO INVESTIGATE MEDIATION OF SKILLS PLANNING AND DEVELOPMENT

3.0 Introduction

This chapter discusses the theoretical framework employed in this study to help answer the primary research question: *What is the theoretical and practical history and current constitution of the agricultural extension officer occupation as a mediating unit of intervention for VET skills planning, and is it adequate for climate resilience?* In response to the limitations surrounding occupation as primary mediating unit of intervention for skills planning and development elaborated in Chapter 2, this chapter seeks out alternative ways of theorising mediating units of intervention for skills planning and development, through introducing the Social Ecosystems Model (SEM) for skills, and Cultural-Historical Activity Theory (CHAT), which I employed to theorise mediation in the SEM for skills. This offers a theoretical framework for the study that offers a different language of description to investigate the dominance of occupation as primary mediating unit of intervention for skills planning and development. In other words I was not trapped by occupation discourse and history in the analysis, given its limitations.

The agricultural skills system encompasses various components, with extension services playing a crucial role as mediators within the broader complex skills ecosystem. Their mediation is influenced by diverse activity systems intersecting with the agricultural skills system in transforming climate resilience skills development, as visualised in Figure 3.10. The joint SEM_CHAT framework provided this study with spatial, as well as cultural and historical theoretical lenses and tools. In this Chapter I describe SEM, its features, application, and relevance to this study. After that, I introduce and describe CHAT, its historical development, features and elements. The chapter also discusses mediation, a concept drawn from SEM for skills, which is central to this study which CHAT theorises. The chapter concludes with a diagrammatic representation of the complex reimagined theoretical framework composed of SEM for skills elaborated with CHAT.

3.1 Social Ecosystems Model (SEM) for skills

This study employed SEM for skills as a broad analytical framework. Hodgson and Spours (2019) referred to SEM for skills as an inclusive approach to skills planning and development

that brings together a variety of social partners/stakeholders around the relationship of working, living and learning, as Figure 3.1 below illustrates this relation, with an emphasis on climate change context of this study. The multiple partners collaborate to develop contemporary skills to address contemporary skills and knowledge gaps as well as planning for anticipated future skills demands for sustainable work and living.

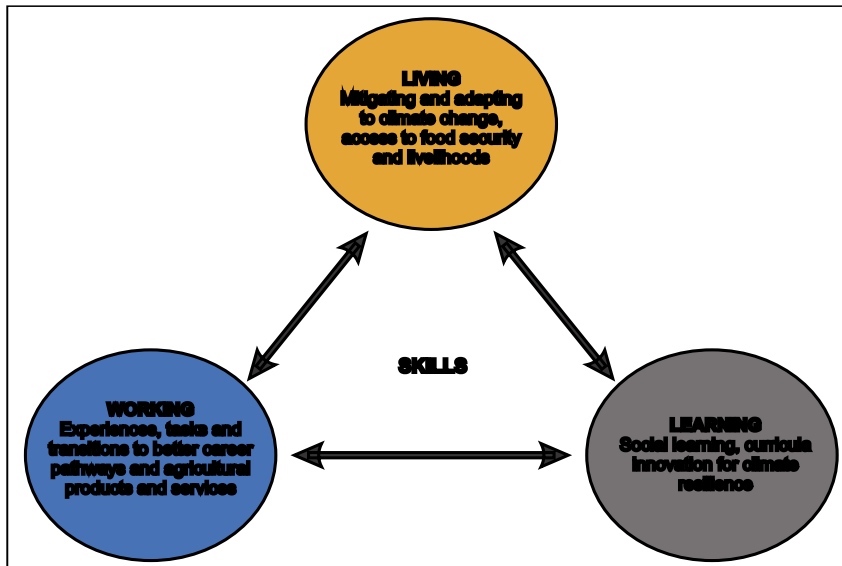


Figure 3.1: Relationship between work, living and learning
 Source: Adapted from Hodgson & Spours (2019)

With its ecological origins, the ecosystem concept traditionally paralleled the ecological metaphor in referencing the natural world’s complex interrelations, as highlighted by Hodgson and Spours (2016). Initially, it focused on the interactions and how plants, animals, and microorganisms function within their environment. Over time, its application broadened, describing dynamic systems marked by functionality, interdependence, adaptability, and development. Brown (2002) emphasised the ecosystem’s dual attributes of vulnerability and resilience while noting the influence of external factors. This multi-faceted view prompted various theorists to adopt the concept, applying it to systems thinking to dissect complex human-social interactions and innovation strategies. Hodgson and Spours (2016) mapped the metaphor’s evolution through four co-existing phases: from nature-based models to complex human activities, progressing to a focus on human skills and technology, and culminating in a post-capitalist global perspective. This adaptive conceptual journey notably shaped early skills research by Finegold and Soskice (1988), paving the way for the subsequent Social Ecosystem Model for skills.

3.1.1 The development of the skills ecosystem research and the Social Ecosystem Model

The SEM for skills emerged from research on skills ecosystems initially conducted in the Anglophone north. One of the pioneering scholars in the skills ecosystem was Finegold, who in his 1999 paper, built upon the foundational work he undertook alongside Soskice in 1988 regarding high and low skills equilibria. In their seminal research, Finegold and Soskice (1988) scrutinised national skill systems, predominantly centred on the UK, contrasting them with the thriving high-tech ecosystem of Silicon Valley that Finegold explored in 1999. The two discerned a glaring deficiency in the UK's managerial and workforce training, positing this as a significant factor in the country's lagging performance compared to other industrialised nations. Their analysis spotlighted superior general education and training systems in competing economies. Finegold and Soskice (1988) advocated for a departure from the prevalent paradigm of inadequately trained managers and workers to reverse the UK's stagnation. Their insights were more profound than a mere call for enhanced training. They identified a multifaceted issue deeply embedded in the systemic supply-demand dynamics of skills, transcending mere educational inadequacies. They proposed fostering collaboration among diverse stakeholders navigating a competitive landscape to untangle this complex web. They believed that entrenched patterns of institutional and societal interplay perpetuated inertia, dampening any zeal for skill enhancement (Finegold & Soskice, 1988).

Finegold (1999, pp. 66-71) suggested four requirements for creating and sustaining a high-skill ecosystem:

- A catalyst to trigger their development;
- Nourishment to sustain growth on an ongoing basis;
- A supportive host environment, and
- A high degree of interdependence among actors in the system.

While groundbreaking, Finegold's insights into Silicon Valley were later understood to be restrictive in their perspective. As indicated by Ramsurap and Russon (2023), Finegold later recognised that his conclusions regarding Silicon Valley potentially oversimplified a broader reality. Notably, high-skilled sectors and regions could co-exist within predominantly low-skilled economies. This acknowledgement mirrors Isenberg's (2010) observations. In analysing the entrepreneurial ecosystem in Silicon Valley, Isenberg pinpointed its success as contingent on its unique context, cautioning against attempts to replicate this model universally. Instead, he championed ecosystems moulded by the specificities of local

entrepreneurial environments, traditions, and style. Isenberg highlighted six critical, context-specific catalysts: a conducive culture, enabling policies and leadership, quality human capital, availability of finance, venture-friendly markets for products and a range of institutional support (Isenberg, 2010, pp. 41-50).

Post-1999, the lens through which high-skills ecosystems were studied began transitioning to a more intermediate focus. This analytical framework transcended its initial boundaries of the UK and Silicon Valley, with countries like Australia incorporating it into their research environment. In the Australian context, Buchanan, Anderson, and Power (2017) leveraged the skills ecosystem concept to pioneer reforms in workforce proficiency. Their in-depth analysis, spanning 100 reformatory projects from 2003 to 2011, aimed to rethink the skills ecosystem, primarily leveraging VET for workforce development. They underlined the critical role of VET in driving broader economic growth, labour market dynamism, and employee relations, emphasising components like organisational frameworks, labour engagement models, policy blueprints, job structures, proficiency tiers, and their genesis.

Other research expanded to cities like New York, where Mulas, Minges, and Applebaum (2015) studied the Tech skill ecosystems. Their findings illuminated the essential role of interconnectedness and community-building in nurturing and maintaining tech innovation ecosystems in urban areas. India's skills ecosystem also underwent scrutiny, with Shrotriya and Dhir (2018) examining the challenges and innovations in enhancing employability. Their proposition was clear: heightening employability is contingent on synergising stakeholders—from policymakers to practitioners—in forging a prolific, innovation-driven ecosystem for quality skills development. Furthermore, in Brown's (2022) research on skills ecosystems he studied India's agricultural skills ecosystem, focusing on understanding how institutional frameworks, particularly those governing vocational education and training in agriculture, influence the utilisation of skills among farmers and agricultural workers. Brown highlights the significance of both vertical and horizontal dimensions within the agricultural ecosystem, focusing on marginalised social groups, such as women, within the agricultural sector. According to him, institutions that support entrepreneurship and informal family and community work settings as crucial sites for skill development and utilisation need to be recognised that is crucial in addressing social inequalities for more equitable outcomes in skill utilisation.

These varied research undertakings on skills ecosystems underscore the inherent complexity in applying the ecosystem framework to study skills. A unifying theme that emerges across these

studies is the indispensable role of connectivity. As Wedekind et al. (2021) observed, networks and connections anchor a skills ecosystem. These relationships can diminish competition, fostering a collaborative spirit when channelled effectively.

Skills ecosystems research initially centred on high-skilled contexts, driven mainly by early studies such as those by Finegold and Soskice (1988) and Finegold (1999). These studies predominantly catered to specific economic sectors like hi-tech industries. However, the global need for skills development demanded a more comprehensive outlook, encompassing both high-skill and low-skill economies, especially in developing nations where informal skills are prevalent. While emphasising high-skilled ecosystems contributed valuable insights, it inadvertently left a research gap in low-skilled contexts, which the SEM for skills sought to address. Building on this trajectory, researchers expanded the application of Finegold's skills ecosystem framework into low-skilled territories, predominantly in South Africa, as seen in the studies by Wedekind and Mutereko (2016), McGrath et al. (2004) and Kraak (1995). The SEM for skills garnered academic interest, stimulating explorations into skills structures within low-skilled contexts, including the VETAfrica 4.0 research programme (VETAfrica 4.0 Collective, 2023).

In this context, this study explored skills development in South Africa and Uganda and observed skills ecosystem ideas as critical to VET skills development for sustainable extension work and agricultural livelihoods (cf. also VETAfrica 4.0 Collective, 2023, Ramsarup, Lotz-Sisitka & McGrath, 2022).

Hodgson and Spours (2016) played a pivotal role in redirecting the lens of skills ecosystems research. Moving away from an exclusive high-skilled framework, their SEM for skills bridged the macro and micro aspects of skills development, areas previously overlooked by traditional skills ecosystem models. While much of the prevailing research explored the areas of innovation and entrepreneurial ecosystems (as noted in works by Isenberg, 2010, Mulas et al., 2015, and Zahra & Nambisan, 2011), there was a discernible gap in studies that centred on place-based skills development within informal environments. Despite its relevance, this narrow concentration on innovation and entrepreneurship often sidelined ecological considerations.

Acknowledging this oversight, Hodgson and Spours (2016) attempted to diversify this narrow perspective on skills development. By 2018 and 2019, they introduced SEM for skills, ingeniously incorporating spatial attributes from Bronfenbrenner's 1979 human-ecological

systems and introducing a third dimension: “mediators and ecosystem leadership” (Hodgson & Spours, 2018, p. 3). This innovation in SEM for skills signified a transformative shift, broadening the view of skills ecosystems research. Their model provides a holistic, place-based and inclusive approach that conceptualises developing skills for formal and informal work and workplace learning through a mediated collaboration between facilitating verticalities and collaborative horizontalities, as seen in Figure 3.2.

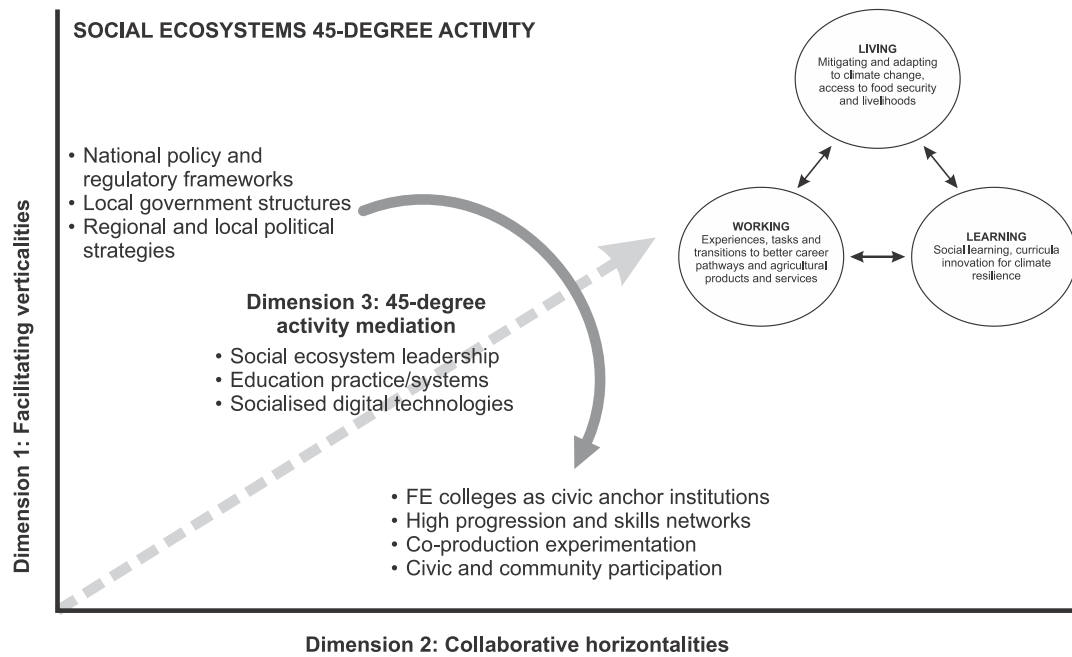


Figure 3.2: Social Ecosystem Model

Source: Hodgson & Spours (2019)

While the high-skills ecosystem approach informs the SEM for skills, the latter foregrounds certain elements that differ from the former’s approaches that emphasise productivism. Contrary to the skills ecosystems research that is narrowly concentrated on high-skilled, elite sectors, the SEM for skills recognises that economic activities and the requisite skills are situated within expansive socio-spatial and ecological contexts (Ramsarup et al., 2022; VETAfrica 4.0 Collective, 2023; Wedekind et al., 2021). This reconceptualisation has cemented the SEM’s status as a holistic model that “emphasises education/employer co-production of skills for an inclusive and more equal community that also links to working and living” (Hodgson & Spours, 2018, p. 4). In alignment with this perspective, the present study deems the SEM pivotal for its research, grounded as it is in low-skills societal settings where informal skills, crucial for economic growth, are predominant. The research harnesses this

framework to ascertain if specific occupations, particularly the extension officer occupation, serve as effective mediation instruments for cultivating climate resilience skills for work and living amidst the changing agricultural landscape due to climate change. The foundational elements underpinning the SEM for skills are elucidated in the next section.

3.1.2 Elements of the Social Ecosystems Model for skills

The Social Ecosystem Model for skills development comprises four key elements:

1. Collaborative horizontalities
2. Facilitating verticalities
3. Mediation activities at 45-degree
4. Ecological time

The first dimension is ‘collaborative horizontalities’. In Figure 3.2, the horizontal axis delineates the concept of ‘collaborative horizontalities’. This refers to a complex web of local networks and diverse actors functioning at the grassroots level. As Spours (2021) elaborated, this encompasses educational organisation and networks, foundational civic entities and local anchor institutions, augmented by the connective capabilities of digital technologies. This horizontal dimension is multifaceted, manifesting spatial characteristics intrinsically tied to specific localities and broader regions (Ramsurap & Russon, 2023). In Hodgson and Spours’ (2019) interpretation of social ecosystems, there is a pronounced emphasis on educational entities, notably institutions dedicated to vocational and higher education (Wedekind et al., 2021). For the SEM for skills model to thrive, network building must eventually lead to institutional building to create robust and inclusive civic anchor institutions. Within the scope of this research, the agricultural system’s collaborative horizontalities and networks might incorporate local educational entities dedicated to skills development, complemented by civic structures such as non-governmental organisations (NGOs).

The second dimension on the vertical axis is termed ‘facilitating verticalities’. These are essentially the overarching national structures combined with empowered local governance mechanisms (Hodgson & Spours, 2016, 2019; Spours, 2021). Facilitating verticalities encompass policies and key stakeholders that foster a holistic approach to living, learning, and working. This includes broad national policy outlines, regulatory structures, strategies relevant to industries and labour markets, and dedicated education and training policies. These catalyse learning and provide a supportive environment such as infrastructure, financial support and

institute regulations. Translating this into the context of agricultural extension, which is the focal point of this study, facilitating verticalities can be seen in manifestations like international policy frameworks, notably the Sustainable Development Goals (SDGs). Moreover, other representative elements might be the prevailing national agricultural policies, agricultural extension strategies, regional governance mechanisms or developmental agencies, and overarching educational policies.

The third dimension of the model is the ‘45-degree of activity mediation’. This is the connection point between the other dimensions (verticalities and horizontalities). According to Spours (2021), mediators of the ecosystem have a common mission. The mediators include organisations and individuals that provide leadership within the ecosystem to connect the two dimensions of horizontal networks and activities with the facilitating verticalities to facilitate skills development (Ramsarup & Russon, 2023; Wedekind et al., 2021). Hodgson and Spours (2019) asserted that ecosystemic planning leadership should be place-based and be capable of defining the problem and the overall goal of inclusive and sustainable social, economic, and educational development. Mediating actors providing leadership and connecting collaborative horizontalities with facilitating verticalities in the current study include political leadership, education systems involving higher institutions such as universities and agricultural Technical Vocational Education and Training (TVET) colleges, extension officers and other existing social learning platforms using socialised technologies.

The SEM for skills has been expanded by Spours (2021) with the addition of the ‘ecological time’ dimension. This stresses the long-term evolution of skills ecosystems in response to changing contexts. Recognising skills development as an enduring journey, Spours highlights that holistic systems development requires persistent efforts, understanding the nuances, and nurturing intricate relationships. Enriching Spours’ elaboration on ‘ecological time’ this current study offers an examination of the history of the extension officer occupation (Chapter 2), and its associated histories in South Africa (Chapter 5) and Uganda (Chapter 6), offering an empirical view of historicity in SEM for skills. This research focuses on the evolution of extension officer’s role concerning climate change challenges, showcasing how skills needs, and provisions have shifted over time. Through this historical lens, the study offers insights into the temporal dynamics of the skills ecosystem (including its cultural historicity), emphasising the need for a mediating unit of intervention for skills planning and skills development to adapt and build resilience against emerging and anticipated climate change concerns.

The SEM for skills, which emphasises a holistic and inclusive approach to skills development, has been vital in understanding skills configurations in developing nations. Various scholars have demonstrated this model’s flexibility and adaptability. A notable adaptation is illustrated in Figure 3.3⁴ where Lotz-Sisitka (2020) contextualised the SEM for skills to the unique needs and challenges of South Africa. She devised tools and methodological lenses tailored for sustainable development, specifically targeting the reconfiguration of green skills. This adaptation aimed at the national Expanded Public Works Programme (EPWP), further reinforcing the model’s relevance and applicability in diverse contexts and objectives. The continuous evolution and customisation of the SEM for skills underscore its robustness and versatility in addressing the multifaceted challenges and needs of skills development in various settings.

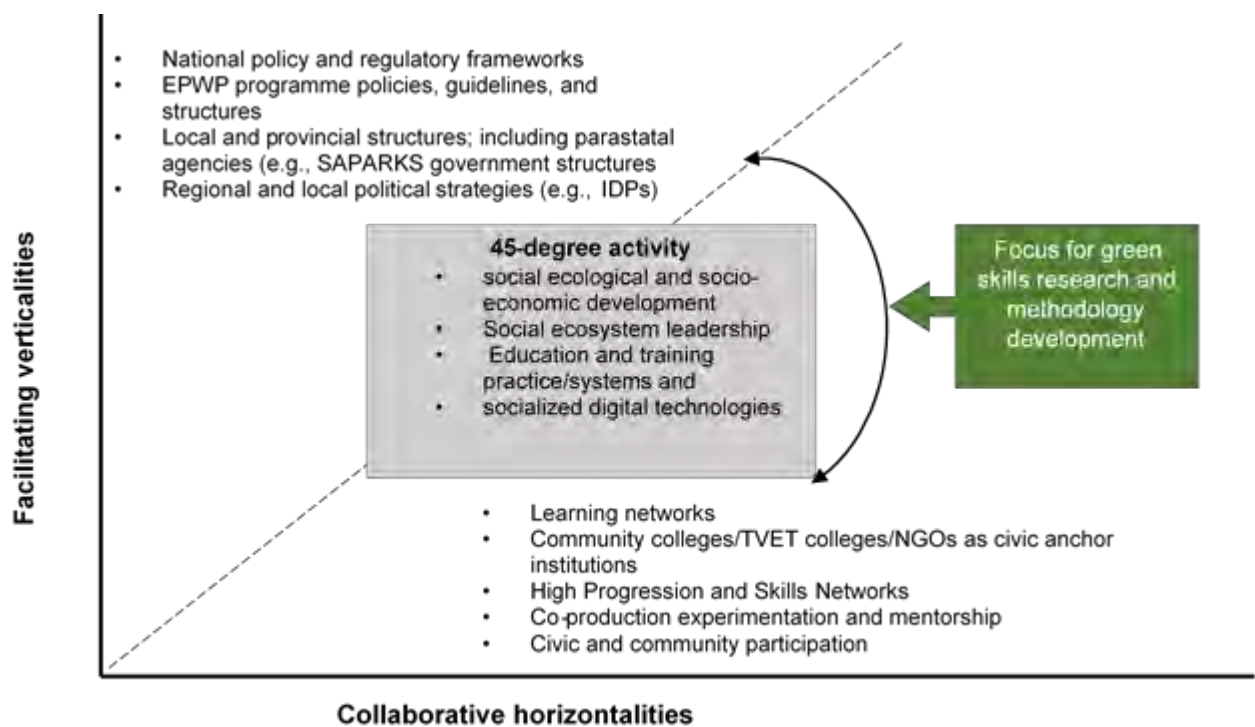


Figure 3.3: Focus on 45-degree activity in social ecosystems research in green skills research and methodology development

Source: Lotz-Sisitka (2020) (as adapted from Hodgson & Spours, 2019)

Lotz-Sisitka (2020) adapted SEM for skills to illustrate its relevance in transforming place-based learning and practice. She suggested the need to develop green skills research

⁴ The current study adapted SEM in Lotz-Sisitka (2020) in Figure 3.3 at the proposal stage and applied it to the agricultural context, focusing on learning for agricultural extension officer occupation and small-medium farming in the climate change context.

methodology to probe the 45-degree activity within SEM orientation that seeks to connect work better, living and learning in the EPWP context in South Africa (i.e. expanded research into mediation). Lotz-Sisitka (2020, p. 118) recognised that SEM provides methodological lenses that offer an “early experimental platform for reconfiguring green skills EPWP research”. This study probes activity at the mediation space (45-degree) of the SEM for skills for South Africa and Uganda’s skills ecosystems, as Lotz-Sisitka suggested, to further understand how education activity and local systems leadership can bring together the actors from the vertical and horizontal dimensions of SEM into a collaboration to develop skills for work and living in the agricultural sector.

As noted above, SEM for skills has also been applied to a more extensive research programme called the VETAfrica 4.0 Collective, where I was a researcher including Alice and Gulu to which my research contributes as introduced in Chapter 1. The project used SEM for skills to analyse regional VET skills configurations in diverse case contexts in Southern and Eastern African countries of South Africa and Uganda, respectively. The cases are located within a broader systemic perspective and political economies, shaping the state-led national formal VET systems deemed ineffective (McGrath et al., 2023; Ramsarup et al., 2022). The philosophy behind VET 4.0 is that VET systems are not functioning effectively and, thus, require new approaches to be transformed to respond to contemporary skills needs and challenges (McGrath et al., 2020) as illustrated in Chapter 1. Across the four cases, the project expanded the notion of skills ecosystems using SEM for skills tools to conceptualise the place-based skills ecosystems, which is vital in building new approaches to VET (VETAfrica 4.0 Collective, 2023). Similarly, this study employed the SEM for skills framework to analyse the extension officer occupation to understand whether it is adequately constituted to respond to emerging climate challenges and build climate resilience for extension officers and farmers and if there is a need for reimagining it. This differentiates my research from the more general research on SEM for skills in the VETAfrica 4.0 Collective.

Figure 3.4 shows a laminated social-ecological ecosystem and a synthesis of the critical project elements emerging from the four cases into multiple scale levels and applied to the expanded SEM for skills. The expanded model illustrates individuals who navigate learning and work transitions within VET systems into transitioning jobs, livelihoods and occupational roles, an element that can strengthen future local economies since it could offer new learning pathways (Ramsarup et al., 2022; VETAfrica 4.0 Collective, 2023). The stars in Figure 3.4 illustrate the position practice systems of diverse agents and their networks contributing to relations of

emergence to the entire ecosystem (Ramsarup et al., 2022). In my study, these agents operate in activity systems as will be discussed further in this chapter. Spours (2023) recently published an overview paper on SEM for skills in which he noted just transitions having the commitment to social justice and sustainability in the model.

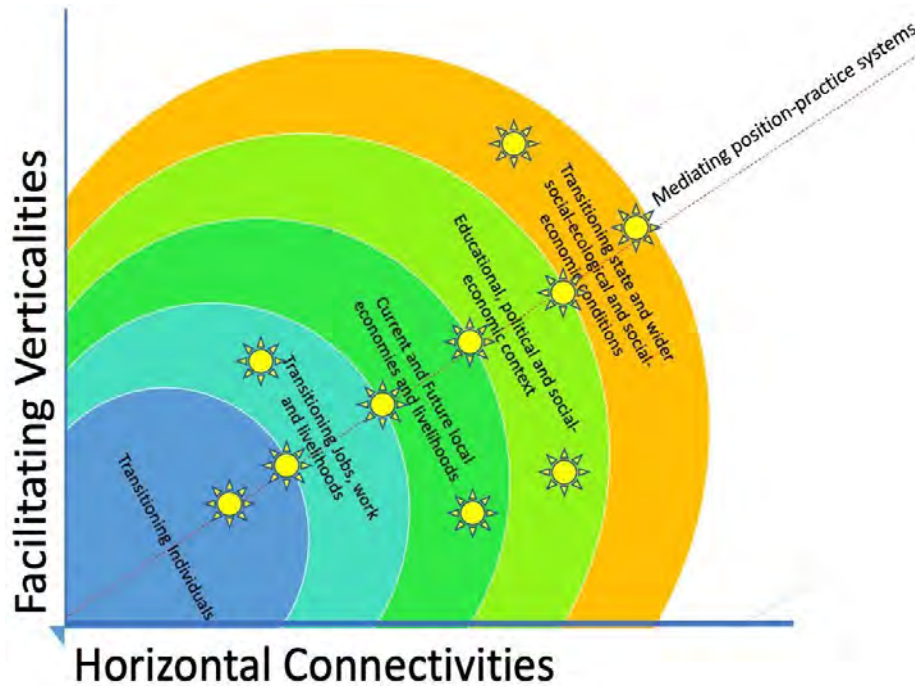


Figure 3.4: Expanded social ecosystem for skills model in VETAfrica 4.0 Collective project
 Source: Ramsarup et al. (2022)

This chapter has so far explicated the vitality of SEM in developing formal and informal skills for work and its consideration of ecological issues. This study particularly adapted Hogson and Spours (2019) model as further adapted by Lotz-Sisitka’s (2020) (Figure 3.3) and applied it to agricultural extension services, with further inquiry into the historicity of and mediation potential in the SEM for skills.

3.1.3 Applying SEM for skills to researching agricultural extension services

This research utilised the SEM for skills to critically assess the extension officer occupation, intending to determine its adequacy to build climate resilience skills in the face of the escalating climate challenges impacting farmers and extension officers. Using the SEM for skills, a comprehensive analytical approach, allowed for a robust analysis of the myriad actors engaged

in skills development, spanning enabling verticalities, collaborative horizontalities, and the crucial mediation level. My study chiefly focused on the historicity of, and mediation level of SEM for skills to discover key mediators that bridge the gap between various stakeholders across the other dimensions.

The role of VET is central to this mediation, especially regarding planning and developing skills. Given the importance of publicly financed VET in Africa for skill development, as discussed in Chapter 1, section 1.2, it remains a fundamental aspect, particularly in the agricultural sector. Here, VET extends its reach by advancing skills development via extension education. Nonetheless, research has indicated that the prevailing VET system in Africa is entangled with restricted occupational structuring, which in turn dictates how skills are developed, stemming from a curriculum that aligns with occupational skill requirements (McGrath, 2011). This notion of occupational structuring alludes to the methodical establishment of occupations as instrumental vehicles for planning and developing skills and strategically allocating resources. Expanding this notion of occupational structuring as a mediating unit of intervention for skills planning and associated implications for skills development within SEM for skills could allow for flexible skills development and planning for future skills not directly aligned to specific occupations but rather streams or bodies of work within a broader field of practice to address pressing climate-induced challenges to work and livelihoods.

In the current study, I employ the SEM for skills to re-think skills and curriculum innovation in agricultural VET programmes, focusing on the primary qualifications used for training extension services in Alice (Case Study 1) and Gulu (Case Study 2). Figure 3.5 below illustrates the mediation space and how supporting facilitating verticalities enables collaborative horizontalities to build (or not) necessary climate resilience skills for sustainable extension work and livelihoods through education, practice, and extension systems.

Other SEM for skills adaptations did not foreground climate resilience, and the current study paid attention to this critical missing aspect. By adopting SEM for skills, focusing on climate resilience, the current study expands on aspects of earlier SEM for skills models from Figure 3.2 to Figure 3.4. Figure 3.5 below illustrates the mediation space where facilitating verticalities combined with enabling collaborative horizontalities work to transform the mediating unit of intervention for developing climate-resilient skills for sustainable development. Figure 3.3 (used at the proposal stage of this study) integrates CHAT to theorise

the mediation space through mediating tools to deeply analyse activities taking place in the extension officer occupation and the broader skills ecosystem. This depiction is illustrated later in this chapter in Figure 3.10.

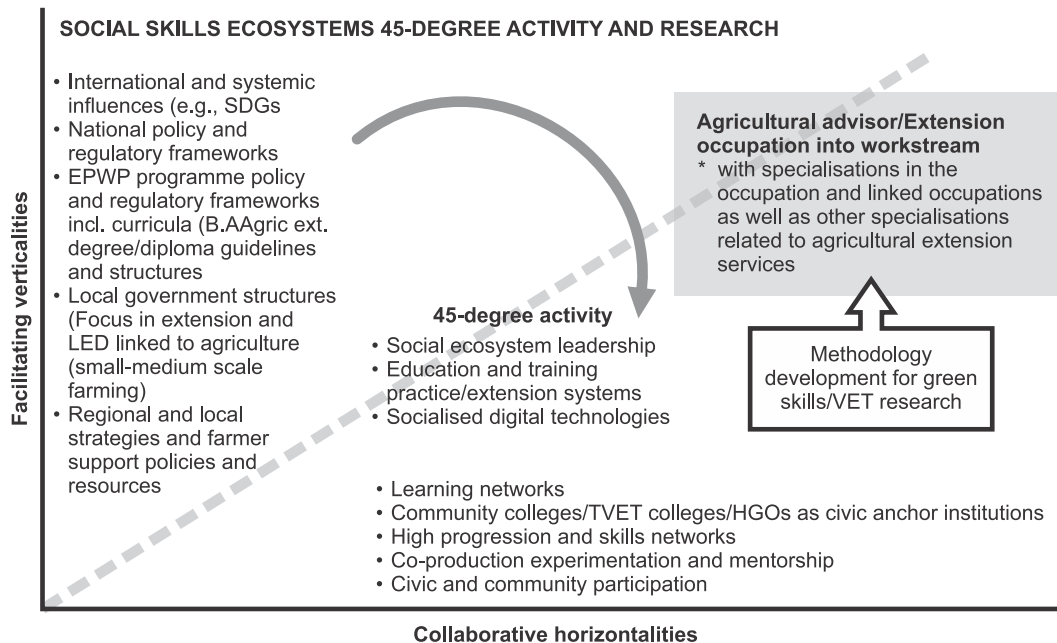


Figure 3.5: Focus on -45-degree activity in social ecosystems research agricultural extension services
Source: Adapted from Lotz-Sisitka (2020) (as earlier adapted from Hodgson & Spours, 2019)

As illustrated above, SEM for skills broadly illustrates elements in the skills ecosystem critical to developing skills. Ramsarup et al. (2022) recognised that the contribution of Hodgson and Spours (2018; 2021) and Spours (2021; 2019) in adding a ‘social’ dimension to Finegold’s (1999) skills ecosystems was critical in offering a broader ontological framing and is more connected to work, living and learning than previous models of skills ecosystems which focused on work and learning.

Whereas SEM for skills is an inclusive approach that recognises the existence of numerous activities, especially in the mediation space (45-degree activity), the model requires further work to theorise mediation⁵. As part of the VETAfrica 4.0 project findings, Ramsarup et al. (2022) also noted the need for more research in the 45-degree mediation space, suggesting further development on this aspect in elaborating SEM for skills. They specifically stated that

⁵ This issue was also discussed in some detail at a recent workshop on SEM for skills hosted by Wits REAL (21-24 November 2023) which I also participated in. By this time my thesis was already in proofreading phase. This served as a triangulation for the potential contribution of this thesis.

in their research, SEM for skills was “limited in explaining how different layers of reality were related to each other” (Ramsurap et al., 2022, p. 572), and they proposed the position-practice system of different actors at different layers as being potentially significant mediation points.

As discussed so far in this chapter, there is an interest in and need for further elaboration of mediation in the SEM for skills to support activity happening in the mediation space, and to deepen understanding of the mediation processes needed in this space to advance skills development. I, therefore, adopted CHAT to further theorise mediation in SEM for skills and used CHAT tools to make sense of different activities in the mediation space and the broader skills ecosystem. Although they look at them differently, both CHAT and SEM for skills are interested in interactions between people and their environment in a broader context as argued by Lotz-Sisitka and Pesanayi (2020). In this case, a joint CHAT and SEM theoretical framework helped to offer a deeper understanding of how knowledge is created through actor-activity system interactions.

In the next section, I introduce and discuss CHAT, while in section 3.5, I explain how this study adapted CHAT into SEM.

3.2 Cultural-Historical Activity Theory (CHAT)

Cultural-Historical Activity Theory (CHAT) is a robust cultural psychology framework developed to understand and expand mediation of human activities deeply embedded within cultural and historical contexts. The term “cultural-historical” underscores the symbiotic relationship between culture and history. As Foot (2014) elucidated, humans constantly interact with and learn from their own cultures and external cultural influences, with all these interactions rooted in a historical continuum with its contradictions. Reinforcing this viewpoint, Roth et al. (2012) emphasised the cultural and historical embeddedness intrinsic to human cognition and actions. By asserting that our present actions reflect historical evolutions, they highlight the indispensability of viewing actions through the prism of their cultural-historical origins.

Furthermore, the term ‘activity’ in CHAT sheds light on the collective actions of people, which, in turn, are moulded by their cultural and historical bearings. Roth et al. (2012, p. 7) encapsulated this by describing activity as an “event of change”, underscoring that our actions, though rooted in personal agency, are seldom entirely our own. This deep interconnectedness to cultural and historical nuances ensures that actions are undertaken within the parameters of

collective intelligibility. Rounding off the acronym is ‘theory’, denoting CHAT’s conceptual stature, serving as a lens through which the complex human activity can be deciphered and understood and expanded, as articulated by Foot (2014) and Engeström (1987).

3.2.1 Activity system of the CHAT framework

CHAT’s foundation lies in understanding ‘activity’; its interpretation has evolved with various proponents. Engeström (1987, 1999) builds on the work of Leont’ev to offer a collective lens, viewing activities as collective actions moulded by communities, emphasising both the scale and form. On the contrary, Leont’ev approached this with a more individualistic perspective, seeing an activity system as rooted in individual human elements and actions (Cong-Lem, 2022; Sawchuk, 2003). This dichotomy between Engeström’s collective orientation and Leont’ev’s earlier more individual focus underscores the dynamic nature of CHAT’s interpretations. However, a unifying thread among these views is the inherent purpose in activities, whether carried out individually or collectively. This purpose aims to effect meaningful change in the world, highlighting the transformative intent of activity systems (Kaptelinin & Nardi, 2006; Peal & Wilson, 2001).

An activity system, as described by Hokajärvi et al. (2009), is inherently dynamic, characterised by its open-endedness, deep-rooted institutionalisation, and the influence of its historical development on its future trajectory. The system’s lack of complete coherence is due to various practices and opinions that populate it, resulting in its multi-voicedness. This multi-voicedness of actors often brings contradictions the activity system as shown in activity system for instance between subject and rules of instrument and object (mainly in the third generation CHAT elaborated in the next section) as shown in Figure 3.6 below. Contradictions are elaborated further later in the chapter in section 3.2.4. Engeström (1987) emphasised the fundamental role of external elements within this context. These elements are instrumental in helping actors within the activity system uncover the underlying meanings of the system’s components, which in turn can catalyse transformative shifts within or of the system itself.

Engeström further deconstructed the activity system into a holistic framework of six interconnected elements: the object, tools, community, division of labour, subject, and rules. This integrated structure, illustrated in Figure 3.6, highlights these components’ interplay in shaping the activity system’s dynamics and outcomes.

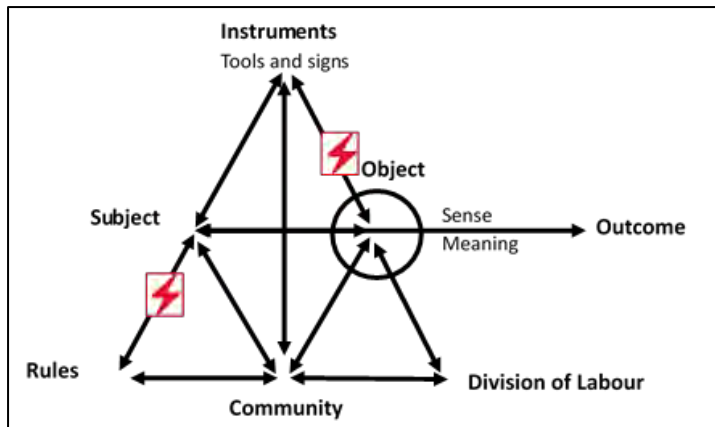


Figure 3.6. Activity system

Source: Engeström (1987)

3.2.2 The development of CHAT

The roots of Cultural-Historical Activity Theory (CHAT) can be traced back to the field of cultural psychology when its founders sought to elucidate the intricate relationship between human cognition and activity. The CHAT pioneers, Russian psychologists Vygotsky and Leont'ev working in the 1930s, derived inspiration from the intellectual legacies of Karl Marx and Friedrich Engels (Engeström, 1999). The work on CHAT was further advanced by Yrjo Engeström and colleagues in the 1980s to today who expanded upon the initial ideas and transformed activity theory into a globally recognised multidisciplinary approach anchored in understanding work dynamics and fostering development (Engeström, 2000; Nardi, 1996). CHAT's evolution can be segmented into three distinct generations.

First generation: Initiated by Vygotsky, this phase primarily revolved around a triadic structure: the subject, the object, and the mediating tool, graphically represented in Figure 3.7. Vygotsky's framework emphasised mediation as the linchpin, with the individual being the primary unit of analysis (Spinuzzi & Guile, 2019). He posited that human consciousness materialises from activities mediated by artefacts, further advocating for a holistic integration of mind and cultural elements (Vygotsky, 1978, p. 35). Central to his discourse was the emphasis on understanding human undertakings as activities oriented towards objects. Consequently, he explored the role of culture deeply in mediating human actions, bridging the gap between individual acts and cultural artefacts, thereby eliminating any dichotomy between individualistic and social paradigms (Yamata-Lynch, 2010).

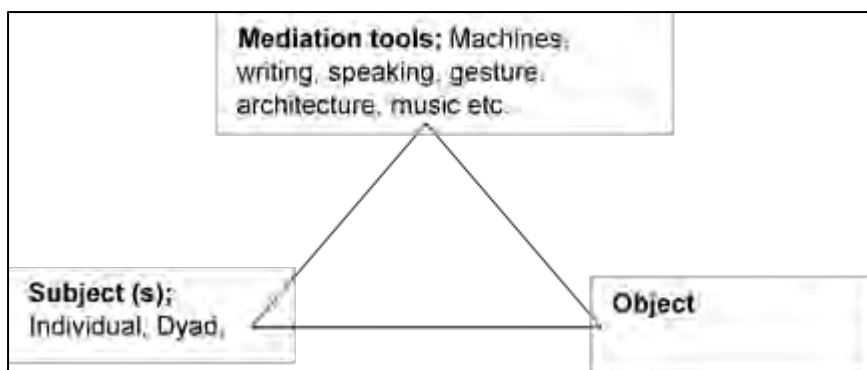


Figure 3.7: Vygotsky's mediation triangle

Source:

Vygotsky

(1978)

Second generation: The second generation of CHAT, spearheaded by Leont'ev, marked a deviation from its predecessor by emphasising the distinction between “individual and collective activity” (Spinuzzi & Guile, 2019, p. 38). Contrary to Vygotsky's focus on the individual as the unit of analysis and his interpretation of object-oriented labour activity rooted in word meaning, Leont'ev expanded the horizon. His conceptualisation, illustrated in Figure 3.8, centred on the intricate interplay between individuals and their encompassing community (Daniels, 2001). Engeström, building upon Leont'ev's foundational work, added depth to the second-generation CHAT. He introduced more dimensions to the triangular model, encompassing facets like the community, rules, and division of labour. This enrichment of the framework provided a holistic lens to examine the multifaceted elements within an activity system, shedding light on the complex socio-cultural influences that shape human actions and their interactions.

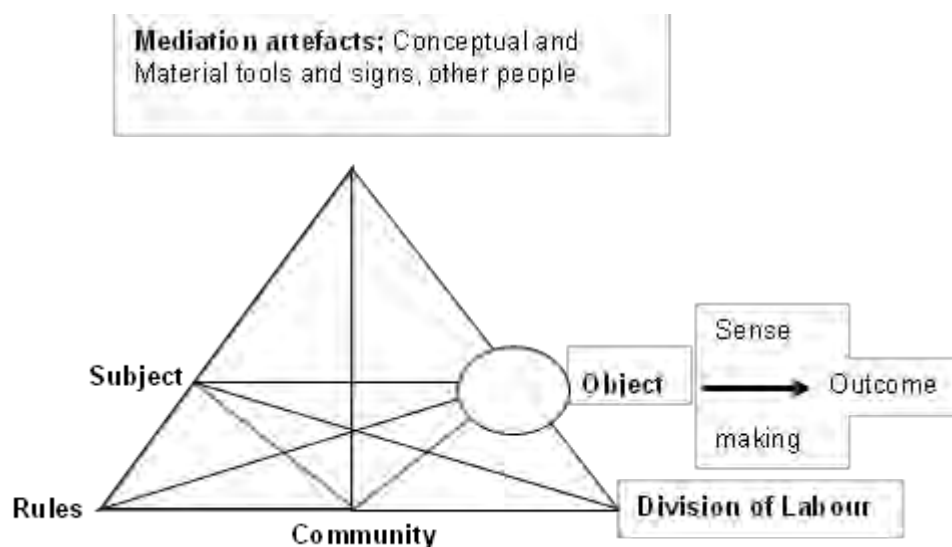


Figure 3.8: The structure of the second-generation human activity theory model

Source: Engeström (1987, p. 178)

Third generation: The evolution of CHAT saw a significant progression with the introduction of the third generation by Engeström. This iteration, distinct from its predecessors, posited that a minimum of two activity systems always coexist. As depicted in Figure 3.9, Engeström’s (1999) framework emphasises the interaction of multiple activity systems, moving away from the singular focus of a central activity system.

At the heart of this paradigm is a shared object, collectively mediated by at least two activity systems. Such a dynamic ensures that the object becomes the minimal unit of analysis. Furthermore, these multiple interacting activity systems necessitate an intricate division of labour. Here, both vertical and horizontal activities manifest differing power dynamics and responsibilities (Engeström & Sannino, 2021).

Engeström’s significant contribution to this third generation of CHAT was his development of “conceptual tools to understand dialogue, multiple perspectives and voices, and networks of interacting activity systems” (Engeström, 1987, p. 6). Through these tools, he unravelled the complex relationships weaving through multiple activity systems. This research leverages Engeström and his associates’ third-generation CHAT as its foundational theoretical orientation.

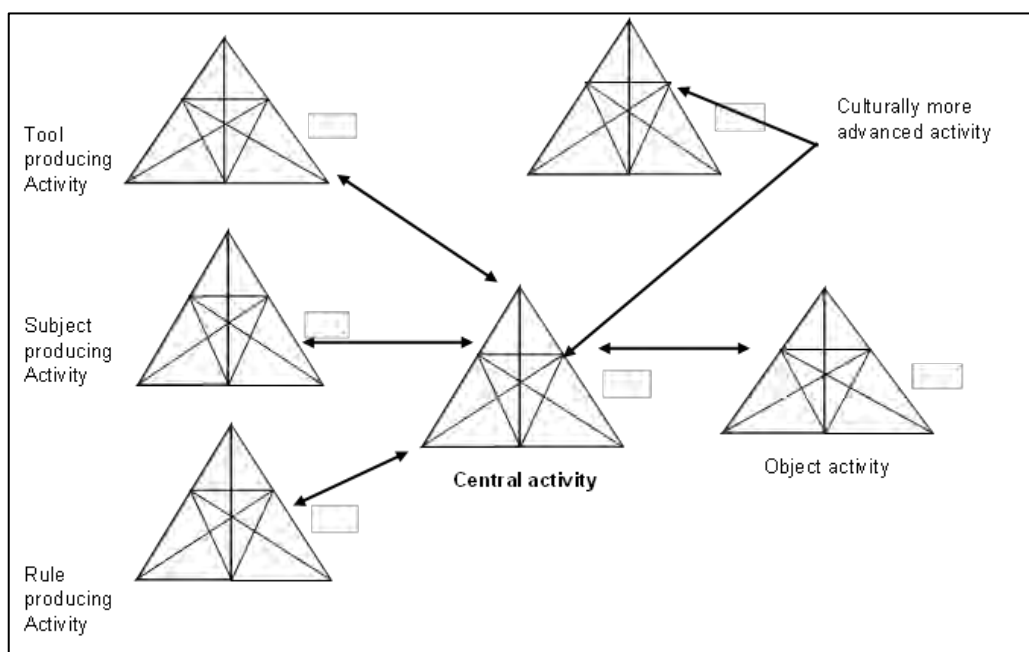


Figure 3.9: Third generation theory: Idealised network of activity systems

Source: Engeström (1987)

Mediation in the SEM for skills is central to this study, and the application of CHAT provided an analytical lens through which this mediation could be keenly understood. Given the intricate web of actors and activities present in the skills ecosystem, I found it helpful to adopt a theoretical framework like CHAT when using the SEM for skills. This approach offers the necessary analytical tools to dissect and understand the dynamics of activities and actor interplay essential in mediating skills development, a discussion further elaborated in section 3.3.2 (see also Chapter 7).

Across varied research contexts, CHAT has offered a systematic and robust framework for analysing mediated activity, whether in professional work, social practice, education, or agriculture (as seen in works like Mukute, 2010; Mukute & Lotz-Sisitka, 2012; Pesanayi, 2019). Central to its appeal is its capacity to dissect and highlight the intricate interplay of history, culture, and power among the actors within a system, and between diverse activity systems that share or partially shared common object (e.g. how to establish sustainable agricultural practice). The strength of CHAT lies in its cross-disciplinary nature, making it adept at explaining how human activities, entrenched in their historical, material, and social contexts, perpetuate transformations in the world (Roth et al., 2012, p. 6).

Furthermore, CHAT is not simply a passive analytical tool. Its mediating instruments empower researchers to actively dissect complex and ever-evolving practices, simultaneously catalysing practitioners to partake in reflective research (Foot, 2014), and expansive learning (Engeström, 1987).

This study adopts three visible CHAT concepts, which will be elaborated later in this chapter. First is the concept of mediation. In theorising the SEM for skills mediation space, CHAT provides mediating tools essential in skills development within a skills ecosystem. The second is historicity. In analysing the mediating unit of intervention for skills, an occupation (extension officer occupation), CHAT provides a historical lens to excavate and provide an understanding of how occupations facilitate skills planning and skills development and how skills ecosystems and institutions have evolved through history. As Roth et al. (2012) asserted, activities are historically situated and socially and culturally mediated. Third is the concept of contradictions. Through contradictions, CHAT helps this study to explain how multiple actors and activity systems interact and how dynamic contradictions influence interactions in the SEM for skills (see also Chapter 7) affecting skills development. In the following section, I explain the elements essential to CHAT worth highlighting in this study.

3.2.3 Elements of a CHAT activity system

This section elaborates on the six elements of an activity system.

Object: CHAT, as highlighted by Engeström and Sannino (2021), underscores the centrality of the ‘object’ in guiding activities. This object, described by Engeström (2009, p. 209) as a ‘concern’, motivates, directs attention, and infuses meaning into actions. Engeström (2001, p. 136) further posits that this object can symbolise a “collective understanding” crafted by the activity system. In this study, ‘climate resilience’ emerges as this pivotal object, serving as the shared challenge that mobilises the various components of the activity system towards collaborative solutions.

Subject: In the activity system, the ‘subject’ is identified as an individual or collective entity whose actions or interventions are the focal point of analysis (Engeström, 2005). These subjects interact with the system’s shared object through various elements like rules, tools, community, and division of labour. Each element is deeply embedded with “cultural meaning and historical development” (Ala-Laurinaho & Koli, 2007, p. 26). For instance, extension officers may represent the subject in a single activity system. This study expands the scope to involve many activity systems and views extension officers as part of the broader extension services activity system.

Tools within the activity system act as mediators, both conceptually and materially, for understanding or transforming the object. These tools, or instruments, encompass the cultural, historical, and skill-based knowledge used in their creation (Cong-Lem, 2022). While skills and competencies exemplify conceptual tools, items like training manuals serve as materialistic tools (Douglas, 2019; Johnson, 2006).

Outcomes in the activity system denote the anticipated results achieved after addressing the object, facilitated by tools and signs (Engeström & Sannino, 2021, p. 8). They are envisioned to bring transformative changes to the entire activity system, potentially introducing new forms of activity (Engeström, 2001). These outcomes can manifest as ‘ideal’ or ‘objective results’ (Leont’ev, 1981). In this research context, with the shared object being climate resilience across various activity systems, the study aims to create an effective mediating unit of intervention for fostering climate resilience skills development within the skills ecosystem.

Community: This is a group of people who share the same object. In the current study, multiple activity systems share the object (climate resilience).

The *division of labour* in CHAT encapsulates both the distribution of tasks and the hierarchy of power and status, affecting the bond between the community and the object (Engeström & Sannino, 2021). In the context of this thesis, within the SEM for skills framework, the division of labour encompasses the allocation of power, tasks, and responsibilities. This is evident in the vertical structures (dominant tool and rule-producing activity systems) and the collaborative horizontalities (interacting horizontal activity systems).

In CHAT, *rules* mediate the interactions between the subject, the community and the object (Engeström & Sannino, 2021). Within the context of the skills ecosystem, specific activity systems are responsible for crafting these rules. In this research, the rule-producing activity systems pertain to national and regional departments that shape policies and laws affecting the extension officer occupation.

This thesis harnesses CHAT's core elements to illuminate actors and activities within the social skills ecosystem. Central to the investigation is the 'object' – climate resilience, a pressing concern that demands attention. This transformative goal hinges on developing skills tailored for climate resilience, with potential mediating tools like the curriculum deployed in agricultural extension training (cf. Pesanayi, 2019). The 'subject' and 'community' symbolise individuals, groups, and institutional stakeholders who align their efforts towards the shared goal of climate resilience. They are situated in a complex web of roles and responsibilities, as depicted by the division of labour in CHAT.

Furthermore, a crucial aspect of this investigation is the interplay of power dynamics in the skills ecosystem. Powerful entities develop and enforce rules and policies, shaping the overarching framework for skills development. Through the lens of CHAT, this thesis seeks to unpack these governing structures, their origins, and their implications at various levels: local, national and global (cf. Chapters 5, 6 and 7). The following section discusses the core principles of CHAT.

3.2.4 Basic principles of CHAT and the activity systems

It is essential to consider CHAT principles when using CHAT to theorise SEM for skills to provide the study with a robust lens for analysing skills in ecosystem mediation and embedded activities. These principles include the following.

Unit of analysis: The first principle of CHAT posits that the primary unit of analysis should be viewed as a “collective artefact-mediated and object-oriented activity system” interconnected

with other such systems (Engeström, 2001, p. 136). These systems transcend singular or group actions, necessitating understanding within the broader matrix of interconnected activity systems. Within the scope of this research, the occupation – specifically that of the ‘extension officer’-is the unit of analysis for skills planning and development utilised in skills ecosystems of both South Africa and Uganda.

Multi-voicedness: The second principle underscores the ‘multi-voicedness’ inherent in activity systems. These systems are a complex of myriad actors – subjects, communities, and those involved in creating and mediating rules intertwined in diverse activities directed towards the object, facilitated by the division of labour. Each actor contributes a unique history, perspectives, and objectives to the system. In the context of this study, the various activity systems, vertical, horizontal, or mediating, harbour distinct historical contexts, each with specific ambitions. Such multifaceted voices within the system can lead to tensions but can also foster innovations (Engeström, 2001; Mukute & Lotz-Sisitka, 2012). As Engeström (2001) pointed out, it is pivotal to approach this multi-voicedness with an ethos of respect, facilitated through efforts like active listening, negotiation, and translation.

Historicity: Historicity stands as a vital principle in CHAT. Rooted in Engeström’s (2001) work, it asserts that activity systems undergo evolution over extensive periods. To truly grasp the essence of these systems, one must examine their historical trajectories, examining their roots, aims, and eventual results (Mukute & Lotz-Sisitka, 2012). Applying this to agricultural extension services, it becomes essential to chart their historical path to appreciate their current state. In the context of this study, Chapters 2, 5, and 6 offer an in-depth analysis of the historical sociology of occupations, explicitly spotlighting the extension officer occupation.

Contradictions: Contradictions are tensions in Cultural-Historical Activity Theory (CHAT), representing structural misalignments that can disrupt the functioning of an activity system (Virkkunen & Kuutti, 2000). Stemming from multi-voicedness, they capture the diverse interests and viewpoints within or between activity systems (Engeström, 1987). When these diverse perspectives collide, they might hinder the system’s smooth operation, introducing disturbances or challenges (Engeström, 1987). Engeström (1987) classified contradictions into four categories:

- Primary contradictions arise within any element of a subject’s activity. An illustration is the dilemma faced when deciding between using or selling a produced item,

showcasing a conflict between the intrinsic value of use and the external value of exchange (Bonneau, 2013; Engeström, 2011).

- Secondary contradictions occur between two components of an activity system. An example includes instances where bureaucratic systems, due to their inherent rigidity, may impede transformative actions like curriculum updates.
- Tertiary contradictions develop when new elements are introduced, creating tension between the old and the new. For instance, a new policy's introduction might create conflict with pre-existing procedures, showcasing this form of contradiction (Bonneau, 2013).
- Quaternary contradictions appear between a primary activity and its neighbouring activities. Engeström (1987) delineated 'neighbour' activities that could result in such contradictions. One example is when a legislative system sets rules for the central activity system. Mukute (2010) added that natural rules like weather or climate can also play a part.

However, contradictions are not merely barriers. As Hokajärvi et al. (2009) pointed out, they can sharpen planning and learning, pushing for either a redefined objective or an expansion of it. Over the long term, contradictions can become innovation catalysts, ushering in transformative shifts within the entire activity ecosystem (Engeström, 2001). Given this study's exploration of multiple activity systems in South Africa and Uganda, such contradictions are anticipated to shape the evolving skills ecosystems as they provide potential points of mediated interaction between activity systems. Engeström (1987) sees contradictions as vital sources for expansive learning.

The principles of CHAT and the activity system are vital in this thesis. For instance, if applied in the context of mediation in SEM for skills, the CHAT unit of analysis in third generation CHAT is conceptualised as interacting activity systems. The multi-voicedness principle highlights the diverse needs, interests and motives of various actors and activity systems in the skills ecosystem. When applied to occupation as a mediating unit of intervention for skills planning and skills development in skills ecosystems, the issue of multi-voicedness and diversity of specialism may be required, in other words the unit of analysis for skills planning and development (i.e. occupation) may need enriching.

3.3 Using CHAT to theorise SEM for skills mediation

Mediation is a central concept in this thesis, with both SEM for skills and CHAT providing unique interpretations. CHAT recognises mediation prominently, placing an emphasis on both materialistic and conceptual tools in the cultural-historical traditions (Johnson, 2006). This view is further expanded upon by Engeström and post-Vygotskian theorists, who see mediation as being driven by material and activity processes (Roth et al., 2012). In this context, CHAT emphasises the necessity for subjects to employ these mediational tools, even incorporating external resources (Cong-Lem, 2022). These resources largely constitute external instruments bridging the gap between different activity systems or their constituent parts.

Wertsch (2007) introduced a dual typology of mediation: implicit and explicit. The former, explicit mediation, revolves around conscious interventions by external entities, be it individuals, systems, or symbols. On the other hand, implicit mediation is a more inward, symbolic process, often operating below the threshold of conscious reflection (Wertsch, 2007, p. 185). Gillespie and Zittoun (2010) further looked into this dichotomy, characterising implicit mediation as being deeply introspective and reflective, while explicit mediation appears more outward-facing and automatic. Vygotsky's perspective comes into play here, suggesting that this mediational process is the conduit through which human consciousness manifests in both social and tangible realms, governed by psychological tools or symbols (Wertsch, 2007).

Elaborating on the role of tools in mediation, Gillespie and Zittoun (2010) differentiate between the functions of tools and symbols in the mediational process. They postulate that tools, within the mediation framework, are instrumental in influencing the external world. This study focuses on the mediation process, specifically harnessing material and conceptual tools, exemplifying explicit mediation. It posits that explicit mediation serves as the foundation for knowledge construction, leveraging tangible materials, artifacts, and tools for skills development within the overarching skills ecosystem. Within educational contexts, particularly formal training for extension officers and farmer-oriented climate resilience programmes, mediation emerges as a tool for knowledge construction. Here, societal instruments, like the study curriculum, play a critical role in facilitating task execution in learning activities (Wertsch, 2007). Within the SEM for skills framework, mediation is perceived as an intervention mechanism in a relationship between different actors operating on both vertical and horizontal dimensions. These mediating agents serve as bridges, integrating the vertical and horizontal aspects into a cohesive relationship encompassing work, living, and learning experiences (Hodgson & Spours, 2021). This integration is most evident at what is referred to

as the ‘45-degree activity’ where the two dimensions converge (Hodgson & Spours, 2016, 2018, 2019; Spours, 2021). The parallels between the mediation processes in SEM for skills and CHAT become evident considering their shared focus. In both frameworks, there is a pronounced emphasis on intentional interferences by external entities; individuals, tools, or symbols, in ongoing activities (Wertsch, 2007). Specifically, in the SEM for skills when viewed with CHAT lenses, actors situated at this mediation space deliberately engage with a shared or partially shared object of activity (e.g. climate resilience) that seek to better connect the vertical and horizontal dimensions, ideally (in the case of this study) improving the ‘facilitating’ nature of verticalities for the benefit of expanded horizontal connections that can advance climate resilience through skills development. This illustrates the applicability of the CHAT mediation concept within the SEM for skills context.

Integrating CHAT into the SEM for skills to elaborate and further theorise mediation offers potential ways to unify various stakeholders within different activity systems in the skills ecosystem. The objective is for the actors to collectively enhance agricultural extension services by instilling climate resilience skills tailored for both extension work and livelihoods for smallholder farmers. Specifically, situating CHAT mediation within the SEM for skills is potentially useful for illuminating the dynamics at the mediation or 45-degree activity. This can help to uncover how stakeholders interact, the nature of their relationships, and the tools they leverage to either drive or hinder interventions aimed at climate resilience, as shown in CHAT studies applied in agricultural settings, with works such as Mukute (2010), Mukute and Lotz-Sisitka (2012), and Pesanayi (2019) showcasing its usefulness. Pesanayi theorised and illustrated mediation processes emerging in third generation CHAT research in Alice and Zimbabwe (Lotz-Sisitka & Pesanayi, 2020) in two contexts where formal and informal skills actors collaborated. However, Pesanayi (2019) while giving some attention to extension work, did not develop his work on mediation around an occupation in a SEM for skills framework, rather he focussed on mediation in and between different activity systems, and identified key mediation processes (e.g. change laboratories, use of social media tools, training of trainers courses and learning network formation) as being helpful mediation processes. What sets this study apart from earlier CHAT studies in the agricultural sector in Africa, is its emphasis on the mediation level of the SEM around an occupation, aiming to bridge the often-overlooked gap between the skills ecosystem’s two dimensions, and implications of this for skills system planning and the conceptualisation of skills system planning instruments. When framing

developmental strategies, skills planning and skills development instruments, this mediation layer is usually neglected.

Predominantly, institutions operating within the vertical and horizontal dimensions of the skills ecosystem lean towards either grassroots-driven (bottom-up) or authoritative (top-down) strategies. These approaches often fail to achieve comprehensive and inclusive outcomes. The problem of linking horizontal activity systems to vertical activity systems has also been identified in CHAT studies (e.g. Mukute, 2010; Pesanayi, 2019). By integrating CHAT within the SEM for skills, this research transcends this dichotomy, and aims for a more holistic strategy for skills development relevant to work and living (Engeström, 2000). Perspectives on diverse activity systems and their roles within the SEM were sought through analysis of various mediating tools fundamental for skills development, particularly within VET institutions (cf. Chapters 5 and 6). This includes tools like study curricula documents, policy guidelines, and frameworks aligned with labour market classifications. It was hoped that this analysis could shed light on respective roles of different activity systems in facilitating skills development in a SEM (Cf. Chapters 5, 6 and 7).

Hokajärvi et al. (2009) posited that meaningful transitions towards sustainability necessitate external thrusts, inclusive of scientific research, to identify and address underlying tensions stalling expansive change that contemporary sustainability demands. Leveraging CHAT to dissect the roles and systems of individual stakeholders/subjects in activity systems also required analysis of the contradictions between different activity systems in order to better understand their potential contributions to transforming extension services in light of climate change challenges and the overarching historical influences requiring essential transformations (cf. Chapter 7).

Figure 3.10 provides a visual representation of the integration of CHAT within the SEM for skills framework. This integration serves as a theoretical underpinning to illustrate that skills systems do not exist in a vacuum; instead, they are deeply rooted in historical contexts and are influenced by both tangible (material) and intangible (conceptual) mediating tools and processes.

This representation potentially enriches prior SEM for skills adaptations as it elaborates on the historical embeddedness of skills systems. This acknowledges that current skills systems have evolved over time, are shaped by past events, practices, and societal norms, potentially offering further insight (empirically) to the concept of ‘ecological time’ as discussed above. By

embedding this rich historical context into the SEM for skills, the study underscores the importance of understanding the origins and evolution of skills systems to make informed decisions about their future trajectory. This will be empirically elaborated in the forthcoming Chapters 5-7

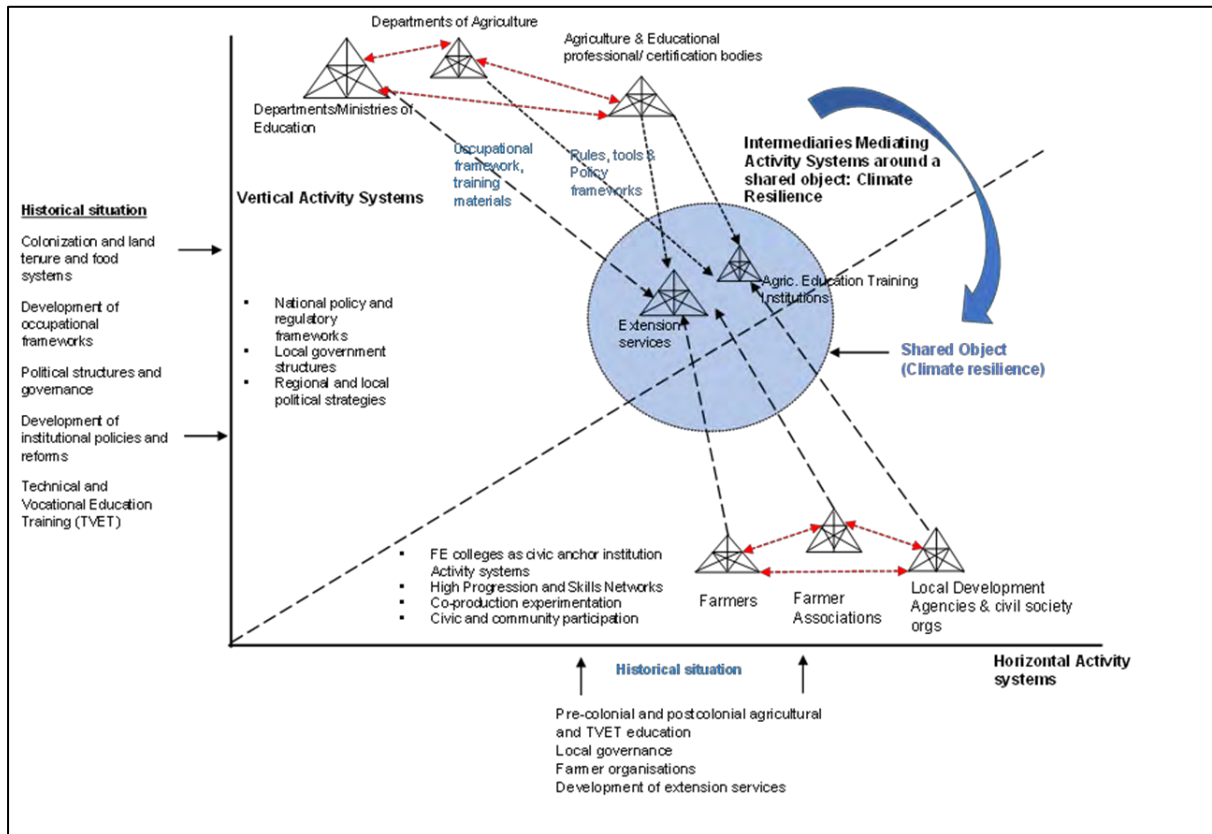


Figure 3.10: A broad conceptualisation of social skills ecosystem and activity in Uganda and South Africa

Source: Author

Figure 3.10 illustrates graphically how CHAT was situated in SEM for skills to theorise the mediation space. The description provided below offers a comprehensive understanding of Figure 3.10:

Framework structure: Figure 3.10 clearly represents the integration of CHAT within the SEM framework. The primary focus is on the mediation space, the central platform where various activity systems interact.

Historical embedding: The vertical and horizontal axes represent the historical continuum that has influenced the evolution of current skills ecosystems, and activity systems and occupational structuring thereof. This rich history, marked by outside arrows pointing towards the vertical

axis, signifies ‘ecological time’ in the SEM for skills constituted by the past influences that have moulded the present skills system situation.

Activity systems interaction: Along the vertical and horizontal dimensions, distinct activity systems are illustrated. Arrows connecting these systems signify their interactions and the dynamic relationships amongst them. These interactions are not isolated but closely connected to the framework’s central theme of mediation.

Shared object(ive): Central to the figure is a circle representing the shared object of climate resilience. Given the complexity of addressing climate change and enabling climate resilience, ideally all actors (subjects in activity systems), regardless of their positioning within the framework, would work collaboratively to transform this shared object into tangible outcomes, making it a focal point of their collective efforts.

Rule-producing vertical dimension: Activity systems positioned at the vertical dimension are predominantly rule-producing (cf. Figure 3.9). They generate various guiding tools like policies, rules, occupational classification systems, etc., that determine the pathway for skills planning and skills development specifically tailored for extension and advisory services.

Mediation space role: The mediation space stands out as a hub of interaction. It not only connects vertical and horizontal activity systems but also facilitates the involvement of external actors, predominantly VET and higher learning institutions. These institutions play a dual role: they provide a leadership and educational role to facilitate skills development with the overarching goal of climate resilience. They are tool producing and subject producing activity systems (e.g. they produce curricula and study materials and extension officers) (cf. Figure 3.9), affecting the climate resilience potential of primary activity systems (farmers and farmers associations) (connected horizontalities in the SEM for skills).

In essence, Figure 3.10 is a comprehensive visual representation that captures the multifaceted interactions of activity systems, historical influences, and the mediating role of VET institutions in the journey towards achieving climate resilience through skills planning and skills development in a SEM for skills. It offers tools for examining a detailed, historically-rooted, and multifaceted view of the skills ecosystem, making it possible to approach the subject with both breadth and depth. The framework was applied to this study, with empirical insights shared in the forthcoming chapters.

3.4 Chapter conclusion

As indicated in the opening of this chapter, it was important to develop a theoretical framework that could offer an alternative to occupation as primary category. Hence I worked with SEM, which I further elaborated with CHAT to offer a broader language of description for this study, and that would allow me to investigate the implications of occupation as primary mediating unit of intervention for skills planning and development empirically.

This chapter therefore discussed the theoretical foundation that anchors this research. The chapter describes the SEM for skills as an inclusive approach that brings together multiple partners in the relationship for working, living, and learning. SEM for skills traces its origins from the ecosystem concept that emerged in environmental studies and found its way and application in skills development research. SEM for skills has four dimensions where actors involved in a relationship of skills planning and development for transformative change are situated; from its collaborative horizontal collaborators and facilitating verticalities, 45-degree mediation activity, and the ecological time which shows that transformation within a skills ecosystem happens over a long period. CHAT which was positioned within the mediation of SEM for skills to theorise it offered useful tools to elaborate the nuanced mediation space in the SEM for skills. CHAT's historicity was useful in excavating the historical situatedness of the skills ecosystems, occupational structuring and occupational frameworks that are central to planning and developing skills. In so doing, the contradictions prevalent in policies backed by their history underpinning and institutions embedded in different activity systems at the various dimensions of the SEM for skills were brought to focus. The multivoicedness of the multiple actors across the different dimensions of the SEM for skills highlights the complexity of managing different voices, and interests of these actors in the transformation of climate resilience which is the shared object(problem). Using the tools CHAT offered were useful in understanding the history of extension occupation in Chapter 2 and country specific contexts in upcoming Chapters 5 and 6. The visual representation of how SEM for skills' mediation was theorised, underscored the potential of such an integrated approach for this study which will be empirically elaborated in the forthcoming Chapter 5-7. Chapter 4, which is presented next, describes the methodology employed in this study, detailing the design, data collection measures, analytical procedures, and standards used to ensure research quality.

CHAPTER 4: RESEARCH METHODOLOGY AND PROCESS

4.0 Introduction

This methodology chapter describes the process I underwent to conduct this research and the research paradigm and design this study employed. Collis and Hussey (2003, p. 1) described research as a process of inquiry and investigation that is systematic and methodical and increases knowledge and attempts to solve specific problems (Sekaran, 2003). As Druckman (2005) asserted, scientific research is conducted for two fundamental reasons: understanding the world and its complexity and solving practical problems. In line with these fundamental reasons, this qualitative study applies a constructivist or interpretive research paradigm to study various aspects within a cross-case study design. The choice of ontological and epistemic positions and the research goal determined the research methodology, design and instruments. The chapter begins by describing the nature of this research, followed by the research paradigm employed. The chapter also describes the cross-case study design employed to research the study phenomenon. The justification for selecting the cases, sampling of participants, data generation tools, methods, and data analysis are described in this chapter. The chapter concludes by discussing the research quality concepts of validity and reliability applicable to this study.

4.1 Qualitative research

Research methodologies can be broadly categorised into qualitative and quantitative approaches. This investigation employed the qualitative approach, emphasising ‘thick descriptions’ of contexts and prioritising the participants’ unique perspectives or emic understandings (St. Pierre & Jackson, 2014). Such understandings are insights that naturally arise from the research context (Tracy, 2019). Rooted in an interpretive or constructivist paradigm, qualitative research deeply explains data collection, analysis and provides detailed interpretation and descriptions of findings (Kayrooz & Trevitt, 2005). In contrast, the quantitative approach, based on empirical, positivist, and post-positivist philosophies, believes in objective reality (Yin, 2018). It leans towards etic understandings, utilising established theories to frame or interpret behaviours (Farquhar, 2012). The subsequent section will elaborate the specific research paradigm guiding this study.

4.2 Research paradigm: A constructivist (interpretive) research paradigm

A research paradigm serves as a lens through which researchers perceive reality, construct knowledge, and collate information about the world (Goertz & Mahoney, 2012). This lens can vary based on one's beliefs about reality (ontology), how knowledge is constructed (epistemology), and the techniques employed in data collection and analysis (methodology). As described in Chapter 3, in this study, the Social Ecosystem Model (SEM) for skills and Cultural-Historical Activity Theory (CHAT) lay the foundation by providing the ontological and epistemological perspectives, guiding the underlying assumptions and inquiries.

Research paradigms can be broadly classified into positivist and interpretive. This study is anchored in the interpretive or constructivist paradigm, underpinned by qualitative methodologies. Central to the constructivist viewpoint is the belief that reality is not a fixed entity waiting to be uncovered but is instead co-constructed and shaped by historical and cultural contexts (Moon & Blackman, 2014). Interpretive researchers argue that our understanding of reality is inevitably mediated through the lens of the researcher and is continually reshaped through social interactions, dialogues, and lived experiences (Tracy, 2019).

As earlier mentioned, ontology refers to the essence of reality and there are two primary ontological stances: realist and relativist. The realist stance asserts that an objective reality exists beyond human perceptions, waiting to be studied and understood (Moses & Knutsen, 2012). This perspective is rooted in the positivist and post-positivist paradigms. Specifically, the positivist approach is grounded in the belief that a singular, tangible reality exists, and the role of research is to observe, measure, and decipher patterns within this reality (Tracy, 2019). Contrarily, the relativist stance emphasises that reality is a subjective construct tailored by individual perceptions and experiences. Thus, it posits that reality varies and is contingent on the person and context, suggesting multiple realities rather than a singular truth (Moon & Blackman, 2014). This study also includes a historical and critical constructivist stance on these realities, hence giving attention to historicity in the analysis.

This research's underpinnings are based on constructivist assumptions, evident in its theoretical and methodological approaches. Central to the study is epistemology, which pertains to how knowledge is understood and framed, addressing aspects like validity, scope, and knowledge

acquisition methods (Moon & Blackman, 2014). This domain encompasses two primary perspectives: objective and subjective epistemologies.

Objective epistemology perceives truth as separate from societal influences, asserting that it can be empirically validated and generalised (Crotty, 1998). Researchers adopting this stance believe in their capacity to objectively assess their subjects, free from personal biases or interpretations (Pratt, 1998).

In contrast, the subjective or constructivist viewpoint contests the idea of a singular, detached 'truth'. Instead, it champions the notion that individuals actively interact with and interpret their world, constructing knowledge and meaning (Moon & Blackman, 2014). This perspective posits that truths emerge from our interactions with the world, as opposed to being static entities waiting to be discovered (Pratt, 1998).

In this research, the overarching SEM-CHAT theoretical framework discussed in Chapter 3 positions human beings within their activities in which they engage. Rooted in the CHAT and SEM for skill framework, it is posited that individuals are not isolated entities; instead, they actively participate in diverse activities, intertwining with both their peers and the encompassing environment, thereby leading to knowledge creation. This framework is instrumental in understanding the complex ecosystem of the extension officer occupation. Not limited to tasks, this ecosystem encompasses intricate networks of institutions, historical legacies, structures (like occupational classification frameworks), systems, and individuals, a narrative detailed in Chapter 2 of this thesis (Moon & Blackman, 2014; Collis & Hussey, 2003).

In relation to the epistemological underpinnings of this study, the approach is firmly anchored in subjective epistemologies. In this context, the researcher was not a passive observer but actively engaged with the tools, objects, and participants to collaboratively construct a nuanced understanding of reality. Such an approach acknowledges the multiplicity of interpretations, with no single viewpoint deemed inherently superior to another, highlighting the intricate dynamics of knowledge construction (Kayrooz & Trevitt, 2005). Especially relevant in a SEM for skills, this knowledge emerges through the interaction of vertical and horizontal activity systems, facilitated by various mediating tools and artefacts. This process and its intricacies are graphically represented in Figure 3.10, as detailed in Chapter 3, section 3.3.

As such, this study assumes an historical constructivist ontological reality, contending that reality is constructed in participants' minds and that the activities within existing structures, systems and institutions are informed and shaped by their cultural histories, which are social as well as material (cf. Chapter 2). Therefore, ontological and epistemological underpinnings were central to understanding the extension occupation, which is the primary mediating unit of intervention for skills planning and development within agricultural extension.

This study, grounded in its ontological and epistemological underpinnings, also leans heavily on specific methodological assumptions. Embracing a historically informed constructivist research paradigm, the study utilised historical and inductive approaches, where empirical themes and categories emerged organically, subsequently undergoing thematic and content analyses as described by Collis and Hussey (2003), but these were also historically informed. To further elucidate the subject, a cross-case study design was chosen, examining instances in both Alice, South Africa and Gulu, Uganda. This methodology, resonating with interpretive paradigms, often associates with hermeneutics and case study methods, placing an emphasis on the historical and social contexts enveloping any given action (Collis & Hussey, 2003). The third chapter of this study outlines the theoretical framework, equipping the research with methodological tools essential for literature review, data collection and analysis, and the understanding of reality construction. Embracing hermeneutics in social science research, as emphasised by Tracy (2019), furnishes deep insight, capturing participants' unique perspectives, lived experiences, and the nuanced understanding of their society, culture, and history. The subsequent section presents the research design employed in this study.

4.3 Case study design

This qualitative study employed an exploratory case study research design and methodology (Cohen, Manion & Morrison, 2018; Yin, 2018) to investigate the agricultural extension services occupation in two selected cases of Alice and Gulu. Cohen et al. (2018) noted that case studies are important sources of research data, whether on their own or if supplemented by other research approaches. I chose a case design for this study because it provides researchers with a systematic design and a methodology (Verschuren, 2003; Yin, 2014). Yin (2014, p. xxii) noted that case study research is a "linear but iterative process" that involves six elements: plan, design, preparation, data collection, analysis and reporting.

The case study research also provides a detailed and “in-depth investigation of real-life project, policy, institution or system from multiple perspectives to catch its complexity and uniqueness” (Cohen et al., 2018, p. 375), which aligns with the epistemological and ontological assumptions adopted in this study (see section 6.2 above) and the historical perspective included.

4.3.1 Cross-case design

In this research, an exploratory international comparative cross-case study design was employed, focusing on the extension officer occupation within two distinct case study locations. Adopting an exploratory case study is particularly beneficial when the subject of investigation lacks a singular predictable outcome, providing room for varied interpretations (Baxter & Jack, 2008; Yin, 2003). Echoing this sentiment, Tetnowski (2015) highlighted the vitality of qualitative case studies in tackling complex real-world challenges. Such case studies, being both adaptable and methodical, enable researchers to elaborate a subject, drawing insights from diverse data sources, and facilitating the nuanced dissection and reassembling of multiple interconnected phenomena (Baxter & Jack, 2008). Yin (2003) suggested that to consider conducting a cross-case design, the study should focus on answering the ‘how’ and ‘why’ questions and the ‘what’ question when there is a need to cover contextual conditions the researcher believes are relevant to the phenomena under study. Moreover, Yin (2018) suggested that cross-case studies provide more powerful conclusions than those from a single case alone. If cross-case studies are selected deliberately due to their contrasting situations, the results present a strong start towards theoretical replication and more robust findings than a single case (Yin, 2018).

In this research, a cross-case analysis was employed to gather insights into the integration of climate resilience within occupational structuring and labour market, the preparation and experiences of extension officers, and relevant histories and policy documents. Utilising a cross-case study approach facilitated the exploration of disparities both within and between the cases, allowing for meaningful comparisons (Yin, 2003). Furthermore, Khan and VanWynsberghe (2008) posited that cross-case analysis is advantageous in highlighting similarities, activities, and processes across cases without making them uniform.

As such, this methodological approach not only facilitates a deeper understanding of individual cases but also extends the researcher’s knowledge and expertise across multiple contexts (Khan

& VanWynsberghe, 2008). Furthermore, it provokes the researcher's imagination, constructs ideals, concepts or tools, and enhances the investigator's understanding of relationships in separate settings (Ragin, 1998).

In this study, using a cross-case design to conduct a cross-case analysis enabled me to gain deeper insights into the occupations (extension officer in particular) through conducting historical analysis complemented by interviews with extension officers, farmers, and lecturers and reviewing secondary policy documents, curriculum, occupational frameworks and the labour market information concerning to climate change. In this research, I heeded Gilgun's (1994) warning against oversimplifying cases to facilitate comparisons, as this could compromise the depth and richness of the meaning inherent in each case (Gilgun, 1994; Tesch, 2013). Given the distinct contextual differences, I individually analysed each case, ensuring the uniqueness of every context was preserved. This approach enriched the insights gleaned from the activities within each country's skills ecosystem. However, Ayres, Kavanaugh, and Knafl (2003) posited that achieving consistency in a cross-case analysis might necessitate some level of simplification, inevitably leading to the loss of certain contextual details. Throughout this study, I aimed to strike a balance between preserving case complexity and ensuring analytical consistency, hence I also developed a theoretical model to guide analysis as shared in Figure 3.10.

In this research, I analysed data for each case independently, identifying themes to extrapolate insights for enhancing historical understanding of occupation as climate resilience skills planning and the implications this has for skills development in agricultural extension services. To ensure the study's feasibility, I defined the scope and boundaries of every case. Given that the distinction between the studied phenomenon and its context can often be ambiguous, as posited by Yin (2009), it was imperative to provide a contextual background for each case study. Taking lessons from Cohen et al. (2018), I positioned each case within its unique setting, ensuring detailed historical and contemporary descriptions to elaborate each case. The subsequent section elaborates the contextualisation of the two cases, which aimed to enhance our understanding of the extension officer occupation within the skills ecosystems within these specific contexts.

4.3.2 Vertical and horizontal international case comparison

In this research, the choice to focus on two distinct countries-South Africa and Uganda from the VETAfrica 4.0 research programme, added layers of complexity due to their differing education systems, historical backgrounds, political orientations, belief systems, and national goals. While making comparisons complex, these differences illuminate distinct patterns and overarching trends across the systems (Chong & Graham, 2013). Such comparative analysis is invaluable for policymakers and practitioners, offering lessons from one context that can be adapted or avoided in another. Chong and Graham's (2013) recommendation of a nested technique aids in dissecting micro-level components while also evaluating them against broader meso- and macro-contexts, ensuring richer and more nuanced findings. Echoing this, Bartlett and Vavrus (2009) advocate for a scaled approach in international comparisons, emphasising that nesting case studies leads to a holistic understanding, bridging global trends with local nuances, thereby paving the way for a more holistic understanding of the topic in focus.

In international comparative qualitative case study research, a vertical comparison spans local, national, and international dimensions (Bartlett & Vavrus, 2009). These scholars observed a prevalent oversight: researchers frequently prioritise a singular local site without sufficiently examining the influences of policy, discourse, and shifts in national and global institutions on local practices. Contemporary qualitative research, they argue, demands both vertical and horizontal explorations. This study heeds this call by leveraging SEM for skills analytical framework, detailed in Chapter 3, section 3.2, which facilitates the examination of regional skills configurations. While this research methodically scrutinises chosen cases, it also employs the SEM for skills to dissect the complex skills ecosystem. This effort underscores the bidirectional relationship: global phenomena distinctly shape, and are simultaneously shaped by, local dynamics. Tools like SEM for skills and CHAT are instrumental in this research, aiding in comprehending the interconnectedness across various scales: from global to local, hence cases described in Chapter 5 and 6 include historical, as well as policy and empirical skills system insights. The CHAT framing assisted with this scope of analysis. Table 4.1 below indicates the way this study conceptualised different CHAT aspects.

Table 4.1. Classification of CHAT elements in the study

Classification	Theoretical frame categories (CHAT)
History of agriculture, extension services, agricultural education, agricultural, extension and land laws and policies and land tenure and associated impact on smallholder farming	Historicity
Smallholders, educators for agricultural extension at selected college and lecturers at university, extension officers, farmer associations and Local Economic Development (LED) agents	Subject
The need to build Climate Resilience	Shared object
Extension services occupation and study curricula	Mediating instruments and tools
National regulatory frameworks, agricultural policy, extension policy and guidelines, extension study curricula, land policy, education policy etc.	Rules
Smallholders, agricultural or extension lecturers at university and college, extension officers, traditional leaders, LED officers and sub-county officials	Community
Roles played by each stakeholder within the extension services occupation	Division of labour

Source: Author

4.4 Data generation

Building on the historically informed constructivist paradigm, this research emphasises a co-creative process where knowledge emerges through historical analysis and the interaction between the researcher and the research subjects. As outlined in section 4.2, the nature of the latter relationship plays a pivotal role in the data collection process. Following the constructivist belief, this study contends that neither the researcher nor the research subject is passive in the process of knowledge creation. Both parties contribute to the hermeneutical understanding of the data, enriching its depth and authenticity (Tracy, 2019). In this study, for both the historical analysis, document analysis (including curricula and policy review), I employed a SEM for skills perspective to gain deeper insights into the functioning of skills ecosystems in South Africa and Uganda and specific Cases of Alice and Gulu.

The subsequent sections 4.4.1 to 4.5 will further elaborate the methodology, highlighting how cases were chosen, the sampling techniques employed, and the processes adopted to gain access and collect data from participants.

4.4.1 Case study sites identification and sampling procedure

I indicated in Chapter 1, section 1.1 that the focus of the VETAfrica 4.0 project motivated my PhD research focus. Similarly, the case selection in this study was fundamentally guided by

my involvement as a research scholar within the VETAfrica 4.0 (VETAfrica 4.0 Collective, 2023). This project covered two countries, South Africa, and Uganda, and comprised four distinct cases. Within South Africa, the eThekweni municipality of Durban city focused on maritime industry skills, while Alice, located in the Raymond Mhlaba Municipality, focused on the SEM for skills for small-scale farmers. In Uganda, the Hoima district case was centred on the skills development in this oil-rich region, and Gulu, a city and its surrounding rural areas, scrutinised the SEM of the predominant economic activity: small-scale farming.

The specific decision to focus on Alice and Gulu for this research also emanated from several other considerations. Paramount among these were the parallel contexts observed in both cases. Both sites predominantly revolve around agricultural activities, especially small-scale farming. This shared context, combined with the primary focus on agricultural extension occupation, rendered these cases particularly suitable for an in-depth cross-case comparative analysis.

In addition to my association with the VETAfrica 4.0 project, my personal interest in small-scale agriculture further steered my choice as introduced in Chapter 1. Alice, in proximity to my university, and Gulu, in Uganda, where I was born, held special significance for me. Familiarity and understanding of the case study location are pivotal in research, substantially influencing my accessibility to research participants. As posited by Yin (2018), in choosing the study site, the researcher needs to ensure that he or she will have easy access to research participants, document records and opportunities for field observations. Fortunately, the boundaries and geographic perimeters of both Alice and Gulu had been previously demarcated by the VETAfrica 4.0 project.

After study site selection, I conducted contextual profiling and a review of literature to gain a deeper understanding of historical and current trends about geography, people, farming and other relevant statistics, as seen in Chapter 5, section 5.1 and Chapter 6, section 6.1. I identified the study participants and activity systems central to this research and extension training institutions.

In advancing this study, my focus was on discerning the curricular frameworks that guide the training of extension officers with regard to climate resilience. For this purpose, I identified key post-school VET institutions in both case study sites. In Alice, the Fort-Cox Agriculture and Forestry Training Institute (FCAFTI) was selected for its diploma programme in

agriculture covering crop and animal production as well as agribusiness specialisations. In Gulu, the focus was on Gulu University. Notably, this university, deeply rooted in community development, emphasises local engagement (see Lotz-Sisitka, Openjuru & Zeelen, 2023). It offers a Bachelor of Science degree in Agriculture, recognised as the primary VET qualification for training extension officers. This exploration aimed at understanding the preparation of extension officers in climate resilience.

4.4.2 Access to study participants and ethics

After identifying the cases and relevant learning institutions, my next effort was to secure access to potential participants from these institutions and the local farming community. For participants from learning institutions, I undertook a formalised approach, submitting written requests to the respective administrations seeking permission to interview both faculty and students. Gratefully, these permission requests were accepted. Moreover, to ensure ethical conduct throughout the research process, it was essential to acquire ethical clearance from the Faculty of Education at Rhodes University, as evidenced in Appendix 3. This clearance was a foundational step ensuring the study's integrity and participants' rights and safety.

This study used natural, purposive and respondent-driven sampling techniques in line with the ontological and epistemological perspectives of this study (see section 4.2) to increase the depth of understanding of reality and create knowledge. Natural sampling occurs when the researcher has little influence on the sample's composition (Collis & Hussey, 2003). Conversely, purposive sampling is more deliberate, targeting specific groups that align with the research objectives (Campbell et al., 2020), and the researcher intentionally selects respondents likely to offer pertinent and valuable insights (Kelly, 2010). This approach is motivated by the goal of securing data aligning with the research's central "questions, objectives, and purposes" (Tracy, 2019, p. 134).

The research strategically chose participants based on their relevance to the study (Etikan, Musa & Alkassim, 2016). In Alice, a focus group of 16 participants at Fort Cox Agriculture and Forestry Training Institute (FCAFTI) completed the Climate Resilience Assessment Tool, and three lecturers and 3 farmers were interviewed. At Gulu University, tool-based assessment involved seven students and three lecturers, including the Head of Department. Three of these lecturers were interviewed and access to farmers in Gulu was facilitated by a university lecturer.

The respondent-driven sampling technique was critical. Here, an initial participant recommended a potential participant believed to be beneficial for the study (Salganik & Heckathorn, 2004). This method was predominantly used with extension officers and farmers. In total, 46 participants across both study sites as seen in Table 4.2, Table 4.3 and Table 4.4, including farmers, students, lecturers, and extension officers (private and public agents) enriched the research. Overall, the combination of these sampling strategies reinforced the depth and breadth of the study's findings, enriching the data's authenticity and relevance.

Table 4.2. Participants of the research in Alice

South Africa			
Participant Code	Profession	Employing Organisation	Qualifications/ Education level
SA-L1	Lecturer	College	Bachelors
SA-L2	Lecturer	College	Bachelors
SA-L3	Lecturer	College	Bachelors
SA-EO1	Extension Officer	Government	Masters
SA-EO2	Extension Officer	Government	Diploma
SA-EO3	Extension Officer	Government	Diploma
SA-F1	Farmer	Self-employed	Unknown
SA-F2	Farmer	Self-employed	unknown
SA-F3	Farmer	Self-employed	Unknown

Table 4.3. Study participants in Gulu

Uganda (Gulu)			
Participant Code	Profession	Employing Organisation	Qualifications/ Education level
UG-L1	Lecturer	University	Masters
UG-L2	Lecturer	University	PhD
UG-L3	Lecturer	University	PhD
UG-EO1	Extension Officer	Government	Bachelors
UG-EO2	Extension Officer	Government	Bachelors
UG-EO3	Extension Officer	Government	Bachelors
UG-EO4	Extension Officer	Private	Bachelors
UG-EO5	Extension Officer	Private	Bachelors
UG-EO6	Extension Officer	Private	Bachelors
UG-FG (1-6)	Farmers (focus group)	farmers focus group	Unknown

Key

SA = South Africa

Private = Employed by a private organisation

L = Lecturer

FG=Focus Group

EO = Agricultural Extension Officer

UG = Uganda

F = Farmer

Government= Employed by the government

Table 4.4. Curricula review focus groups

Case 1: Alice, South Africa			
Institution	Study course	Specialisation	Nature and Number of Participants
FCAFTI	Diploma Agriculture	Crop production	5 students
		Animal production	6 students
		Agribusiness	5 students
Uganda			
Gulu University	Bachelor of Science (Agriculture)	N/A	10 (4 lecturers and 6 students)

4.5 Data collection

This study used qualitative methods to generate data from both primary and secondary sources. The data collection methods included historical analysis of text, primary in-depth interviews and focus group discussions, and secondary document analysis. The secondary documents analysed were the study curricula obtained from the selected institutions employed to train extension officers, occupational classification frameworks, and labour market information (including job adverts). I also reviewed policy documents on VET and extension to understand how policy integrates climate change and to develop historical understanding.

4.5.1. Historical sociology and policy analysis research

This study employed a methodological approach for analysing historical literature and text, as Kapping, Wadhvani, and Bucheli (2014) advocated to develop a robust historical sociology of occupations and extension in Africa and country contexts. The exploration into the historical sociology of occupations, the evolution of extension services in Africa, and extension policy in specific country contexts was guided by Cultural-Historical Activity Theory (CHAT), mainly focusing on cultural historicity of the extension occupation. Additionally, the SEM for skills was utilised to understand history guided by the ecological time concept, aiming to unearth the historical context that underpins the current reality of activity systems and the overarching skills ecosystem in South Africa and Uganda.

In this study, the historical texts examined comprised materials that did not directly observe the research subject. Often, these were incomplete event narratives influenced by the institutional or personal biases of the authors. In interpreting these texts, I remained cognisant of their production within social and cultural contexts. I sought to be reflexive throughout to ensure that my knowledge of the South African and Ugandan historical contexts did not

influence my interpretation of the identified historical text. The analysis process primarily involved scrutinising written documents and artefacts (including policy and curriculum documents as defined by CHAT). The historical analysis held cultural historicity and SEM for skills perspectives in mind, to better understand the historical situatedness of the skills ecosystem response to the extension occupation in South Africa and Uganda and its responsiveness to climate resilience or not. This was done through three key steps: critiquing each text source to determine its internal and external validity, historical source triangulation, and situating text in its historical context. It is important to note that these procedures were not implemented linearly. Instead, they were iteratively applied to analyse and interpret the historical texts, ensuring a comprehensive and nuanced understanding of the data.

In conducting historical analysis, particularly in critiquing sources and authors of historical texts, the guidance of Kapping et al. (2014) was instrumental. They emphasised the importance of considering an author's intent as a crucial element in assessing the credibility of a source. This approach aligns with the perspectives of McDonnell, King, and Soule (2015), who highlighted that understanding an author's motivation is critical to distinguishing between politically motivated writing and independent authorship, thereby minimising reliance on biased sources.

In this study, the sources, peer-reviewed journal articles and books containing historical texts, were accessed from reputable academic databases, including Scopus, JSTOR, ProQuest, SAGE, Google Scholar and ScienceDirect. Other documents, such as policies, strategies and plans published online, were accessed through the Google search engine. Materials in hard copy, including academic books, were utilised. This selection process was crucial in ensuring the credibility and relevance of the information analysed. Moreover, as Gaddis (2002) advocated, the analysis was conducted with a commitment to transparency. This was achieved by linking authors' claims to their sources and providing detailed bibliographic descriptions. These descriptions included the author's or writing organisation's name, publication details, the date of document creation, location, and specific document identifier codes or website links, where applicable. The practice of source criticism, as detailed by Kapping et al. (2014), further reinforced the robustness of the analysis. This methodological step was essential in understanding what the source contributes to the topic and in recognising the limitations of relying on a particular source. Such a critical approach to historical text analysis ensured a

more nuanced and comprehensive understanding of the subject matter and maintained the integrity and objectivity of the research.

Furthermore, the methodology for analysing historical texts was also underpinned by a triangulation process, as Berg and Lune (2012) and Denzin (2010) recommended. This approach aimed to cross-check, corroborate, and validate historical information, thereby enhancing the confidence and robustness of the results in line with the principles outlined by Buchanan and Bryman (2009). Triangulation involved consulting many sources to capture a breadth of perspectives and provide a comprehensive and accurate analysis of historical events related to occupational guilds, agricultural extension, and the history of agriculture, land and extension policy in South Africa and Uganda. Ricoeur (2004) highlighted the importance of using heterogeneous sources in historical research to avoid the oversimplification and potential inaccuracies of single-perspective narratives. This study's varied source base proved particularly useful in identifying contradictions in literature and policies, especially regarding the evolution of agricultural policies. These diverging perspectives illuminated the complexity and inherent contradictions within the skills ecosystem in both South Africa and Uganda.

Triangulating these multiple historical sources was also essential for integrating primary and secondary data used in the research and for the post-analysis interpretation of the study's findings. Berg and Lune (2012) supported this approach, emphasising that the incompleteness of historical sources necessitates using secondary data to adhere to methodological rigour and ensure source heterogeneity. Secondary sources were also utilised, as will be further elaborated in this chapter in section 4.5.4.

Another critical aspect of analysing historical texts was situating the historical texts within their respective contexts, a process commonly referred to as the "hermeneutic circle" (Kapping et al., 2014, p.312). Hermeneutic interpretation requires attentiveness to the social and cultural context of the source's production and its temporal embeddedness to understand the context of events occurring before and after the text's creation (Khaire & Wadhvani, 2010). This interpretive approach was vital in understanding how history has shaped the current reality of occupations, occupational structures, activity systems and skills ecosystems in both cases. Such an analysis offered insights that recent histories and contemporary perspectives might not provide, thus enabling a deeper understanding of the research subject. In analysing the literature, I remained aligned with my study objectives, ensuring that the gathered literature

contributes to answering the research question and specific study objectives outlined in Chapter 1.

4.5.2 Semi-structured interviews and focus group discussions

In this study, in-depth interviews were the primary method of data collection together with documentary analysis. Tracy (2019) posited that qualitative interviews allow for mutual discovery, understanding, and reflection, offering an energising experience for both the researcher and the participant. The Covid-19 pandemic necessitated adaptability in approach; while face-to-face interviews were preferable, online platforms like Zoom became essential, especially in Alice. By August 2021, restrictions in South Africa had eased, allowing face-to-face interactions with Fort Cox Agriculture and Forestry Training Institute lecturers and students. In Uganda, while there were strict Covid-19 protocols in place, interviews with lecturers, extension officers, and farmer focus groups were conducted in person, adhering to safety guidelines.

In this research, I utilised a semi-structured interview schedule (refer to Appendix 2) that provided ample flexibility to examine the subjects the participants deemed vital. This approach facilitated an organic exploration of participant experiences, allowing them to share their narratives and opinions relevant to the investigation (Tracy, 2019). During interviews in the field, I was reflexive enough to take account of my subjectivity in the research, given my position as a researcher in the VETAfrica 4.0 Collective research programme, which focused on the cases I investigated. I ensured that my knowledge of the subject and context did not influence the participants' views during interviews. Furthermore, I exercised emotional reflexivity as farmer interviewees told their stories, narrating their experiences with climate-induced impacts on their lives and livelihoods.

To ensure data integrity, interviews were recorded with a secure audio device and subsequently stored on encrypted cloud storage. I used Otter, an automated online transcription service, to transcribe the interviews. Post-transcription, I rigorously reviewed and cross-referenced each transcript against the original recordings, making necessary corrections to ensure accuracy and authenticity of the data. During this research, I grappled with challenges typical to qualitative interviews. Notably, the method was time-intensive and required sustained focus from both my participants and myself. This intensity occasionally resulted in what King (1994, p.33) terms an “overload of data”, which, for some busy participants, elicited feelings of discomfort and

unease. However, spanning 18 interviews across two months offered some flexibility, permitting me to effectively coordinate, schedule, and when necessary, reschedule interviews. This ensured participants' convenience while maintaining the integrity and depth of the gathered data.

Focus groups played a crucial role in my research methodology, serving as informal discussions centred around pre-selected topics. While two types of these group discussions were organised, they were all aimed at gaining insights on specific research elements. In Gulu, two focus groups were organised: one with educational stakeholders (students and lecturers) to review the Climate Resilience Assessment Tool, and another with local farmers. A singular focus group was held in the South African study site with educational stakeholders since it was possible to conduct personal interviews with farmers.

Conducting a focus group with Gulu farmers was influenced by several factors. Chiefly, language barriers existed, making individual interviews challenging. Consolidating these interactions into a single group discussion, where farmers could comfortably express themselves in their native tongue amidst familiar faces, was both efficient and conducive to producing richer data. With the aid of a lecturer from Gulu University, who acted as an interpreter, I was able to pose open-ended questions, fostering a vibrant discussion. This approach aligned with Wilkinson's (1998) advice on homogeneity in focus groups and Breen's (2006) endorsement of focus groups' efficacy in creating environments conducive to honest expression, ultimately enriching the researcher's comprehension of the studied phenomenon.

4.5.3 Reviewing curricula using Curriculum Resilience Assessment Tool

The curriculum review was an integral part of this study, which involved a collaborative process with the participation of both students and lecturers. These participants were thoughtfully chosen by contact lecturers, ensuring that they were both available and insightful regarding agricultural extension studies. To carry out this curriculum review, I adapted the Unit-Based Sustainability Assessment Tool, originally crafted by Togo and Lotz-Sisitka (2009). This tool is renowned for its widespread adoption in universities across the globe and particularly in Africa, serving to gauge the sustainability of Vocational Education and Training (VET) programs. The Unit-Based Sustainability Tool, known for its adaptability, has been effectively utilised in research contexts akin to this study. For example, Van Staden (2018)

employed this tool to examine climate-smart system innovations at two agricultural colleges in the Northwest province of South Africa. This tool's capacity to assess the climate responsiveness of VET study programmes in agricultural colleges particularly attracted me to it for my research.

In the context of this research, the tool was adapted to assess the level of climate resilience incorporated in the curricula of VET programmes designed for training agricultural extension officers at the selected institutions in Alice and Gulu. Named the Climate Resilience Assessment Tool (detailed in Appendix 1), it was presented to both staff and students of the selected institutions to gather insights on the curriculum's alignment with contemporary needs concerning climate change in the domains of work, living, and learning.

The assessment tool is structured into four distinct sections:

- Section 1 Curriculum (content and topics)
- Section 2: Programme teaching approach.
- Section 3: Research and innovation for climate resilience
- Section 4: Community engagement in climate resilience initiatives

To explain the methodology employed to review the curriculum's responsiveness to climate resilience using the Climate Resilience Assessment Tool, every indicator in the tool was rated on a Likert scale starting from 0 (lowest) to 5 (highest). This scoring method is illustrated in Table 4.5. After gathering the scores, they were entered into tables, and an aggregate analysis was done using Excel; the computations are shown in Appendix B1-B3 and Appendix C. The scale of 1 to 5 was converted into percentages, where each value (1 to 5) corresponded to a 20% increment. In this criterion, 0 stands for 0%, signifying an absence of climate resilience responsiveness. A score of 20% suggests that the indicator does not sufficiently address climate responsiveness. A score of 40% means it is performing but requires improvement. A score of 60% is indicative of acceptable climate resilience integration, 80% reveals that the curriculum satisfactorily addresses climate responsiveness, and 100% implies an excellent climate resilience integration that exceeds requirements. After this process, I averaged the scores for each section to derive an average score for the curriculum's climate resilience, as Table 4.6 below shows.

The results of this analysis are elaborated in forthcoming Chapters 5 and 6 and visualised in Chapter 5, Figures 5.1 through Figure 5.3, for the Diploma of Agriculture in Alice, and Figure

6.1 in Chapter 6 for the Bachelor of Science in Agriculture in Gulu. As shown in Chapter 5, the Diploma in Agriculture is taught in three distinct specialisations, each warranting individual analysis. In contrast, Chapter 6 presents a review of the Bachelor of Science in Agriculture, which is offered as a singular, comprehensive programme. This difference in programme structure is the reason behind the separate analyses for the Diploma specialisations visualised in Chapter 5, Figures 5.1 to 5.3 and the consolidated analysis for the Bachelor’s programme, as visualised in Chapter 6, Figure 6.1. Table 4.5 below outlines the criteria employed to gauge how attuned the curriculum is to the demands of climate resilience.

Table 4.5. Assessment criteria for the Climate Resilience Assessment Tool score analysis

Rating		Assessment criteria	Percentage equivalent
0	None	There is no evidence on the indicator	0%
1	Unsatisfactory	The indicator does not meet the necessary requirements	20%
2	Needs development	Indicates performance, but requires improvement	40%
3	Adequate	Evidence show adequate climate resilience responsiveness	60%
4	Meets requirements	Evidence indicates that the climate resilience responsive standard has been met	80%
5	Exceeds requirements	Evidence indicates that expectations have been exceeded and climate resilience responsiveness has been successfully attained	100%

Source: Author

The assessment derived the overall percentage reflecting the curriculum’s responsiveness to climate resilience for each section or indicator cluster. To do this, scores were divided by the number of indicators, producing percentages for every section. These percentages were then mapped against the following criteria outlined in Table 4.6 below, and the computations conducted in Excel can be seen in Appendices B1-B3 and C.

Table 4.6. Score Analysis for Climate Resilience Assessment Tool

Tool Section (e.g., C1, C2, C3, C4)					
Section/ indicator cluster	Indicator codes; A1, A2	Topic/ indicator	Total score (sum of Individual indicator scores)	Average Score (Total score ÷ number of participants) ÷ Likert scale max	% Climate responsiveness (Average score ÷ No. of indicators)
Total section sum /no. of indicators (A1+A2+A3+A4+A5+A6)					
Climate resilience responsiveness (%)					

Source: Author

4.5.4 Literature review and document (material tools) analysis

The role of a literature review and document analysis in qualitative research cannot be overstated. As Bardach (2009) highlighted, the primary data sources in policy research are documents and human interactions. Before conducting fieldwork, gathering background knowledge from available documents is essential in shaping the research design and guiding the interview process, as Yanow (2007) recommended.

In this research, the documentary review functioned as a tool to deepen the understanding of the study's central themes. It went beyond merely analysing specific documents; it involved thoroughly examining, reviewing, and synthesising documents and relevant scholarly literature for each Case site. As observed by Snyder (2019), the documentary review is a robust method in qualitative research. When it draws from various empirical studies, it can effectively address research queries. Furthermore, Evans and Kowanko (2000) recognise the potential of documentary and literature reviews to unearth overarching evidence and pinpoint areas needing further exploration. In this research, the case-based literature and document review helped shed light on the profession of extension officers and the historical context of occupations, which is discussed in depth in Chapters 2, 5, and 6.

With document analysis, documents may confirm “observational and interview data, or they may refute them, in which case the researcher is ‘armed’ with evidence that can be used to clarify, or perhaps, to challenge what is being told” (Yanow, 2007, p. 411). Cognisant of this, I used a blended methodology and analysed documents (material artefacts) to provide enough depth to my data. I was also mindful of the context of each document I reviewed. Below in Table 4.7 are the documents (material artefacts) I analysed for each case.

Table 4.7. Analysed secondary data sources

UGANDA				
Document title	Publication date	Author	Focus of Analysis	Date accessed
International Standard Classification of Occupations (ISCO-08)	2012	International Labour Organisation (ILO)	Occupational codes, titles, and task descriptions, categorisation of extension services	12 November 2022
Uganda Vision 2040	2013	National Planning Authority	Climate change, agricultural extension, training and skills development, climate mitigation, adaptation/resilience	23 November 2023

National Adaptation Plan for the Agricultural Sector	2018	Ministry of Agriculture, Animal Industry and Forestry (MAAIF)	Policy on climate and change in extension services and actions for climate resilience.	9 October 2022
National Agricultural Extension Strategy (NAES)	2016	Ministry of Agriculture, Animal Industry and Forestry (MAAIF)	Role of extension officers, policy on climate change in extension services, skills and competencies, and extension approaches implemented in Uganda	01 April 2023
Uganda National Climate Change Policy	2015	Ministry of Environment	Focus on extension services and its main objective on climate change	26 April 2023
Agricultural Extension Guidelines and Standards	2019	Ministry of Agriculture, Animal Industry and Forestry (MAAIF)	Extension and climate change	24 March 2023
Curriculum for the Bachelor of Science in Agriculture	2017	Gulu University	Course units that include climate change related aspects.	12 January 2023
Technical and Vocational Training (TVET) Policy	2019	Ministry of Education and Sports	Policy reference to climate change, extension services	16 January 2023
Third National Adaptation Plan (NDP III) (2021-2025)	2020	National Planning Authority (NPA)	Climate change action plan, climate resilience and extension services policy measures	10 May 2022

Job Adverts

Job Advert 1: <https://www.o4ug.com/agriculture-extension-officers-4/>

Job 2: <https://www.devex.com/jobs/agriculture-extension-and-outreach-advisor-511744>

Job advert 3: https://www.hotugandajobs.com/job/agronomy-officer-2-positions-amudat-and-karenga/?utm_campaign=google_jobs_apply&utm_source=google_jobs_apply&utm_medium=organic

SOUTH AFRICA

Document title	Publication date	Author	Focus of Analysis	Date accessed
Framework for Occupations (OFO)	2013 and 2021	Department of Higher Education and Training	Agricultural extension officer and related occupations and their role descriptions	10 September 2022

Curriculum for the Diploma in Agriculture for Fort Cox Agriculture and Forestry Training Institute (FCAFTI)	2018	FCAFTI	Course outline that includes climate change related content	9 February 2023
Agricultural Sector Skills Plan (SSP; 2020-2025)	2020	Agricultural Sector Education and Training Authority (AgriSETA)	Extension, climate change TVET occupational skills development	23 November 2021
National Development Plan 2030	2012	National Planning Commission	Climate change related statements and action plans	20 April 2021
National Policy on Extension and Advisory Services	2016	Department of Agriculture, Forestry and Fisheries	Climate change policy measures and actions, extension role in climate change resilience	10 November 2022
National Education and Training Strategy for Agriculture, Forestry and Fisheries	2015	Department of Agriculture, Forestry and Fisheries	Climate education and extension services, policy and action measures for climate resilience	11 November 2022
Presidential Climate Commission (PCC) Framework for a Just Transition	2022	Presidential Climate Commission	Climate change policy measures and action plans in agriculture	24 April 2023
National Climate Change Response White Paper (2011)	2011	Department of Forestry, Fisheries and Environment (DFFE)	Climate change and agricultural extension, training and skills development	10 November 2023
White Paper for Post-school Education and Training (2013)	2013	Department of Higher Education and Training (DHET)	Extension, climate change-related training and skills development	10 November 2023
National Skills Development Plan (NSDP)	2019	Department of Higher Education and Training (DHET)	Extension, climate change-related training and skills development	10 November 2023
<p>Online resources and job adverts The analysis focused on key occupational requirements and NQF qualifications and the DHET careers advice portal's analysis focused on related occupations and qualifications.</p>				

Job advert 1. Vacancy circular at:
<https://www.dpsa.gov.za/dpsa2g/documents/vacancies/2023/PSV%20CIRCULAR%2002%20OF%202023.pdf>
Job Advert 2
:https://www.joblife.co.za/viewjob/agricultural_advisor_extension_services_x_13_positions-2593321936
Job Advert 3.
<https://www.dpsa.gov.za/dpsa2g/documents/vacancies/2022/CIRCULAR%2034%20OF%202022.pdf>
DHET Careers Advice Portal: <http://ncap.careerhelp.org.za/occupation/6D4E0F67-0EB6-4A42-ADA4-3DD62C260211>
Job portals: <https://za.indeed.com/Extension-Officer,-Agriculture-jobs?vjk=904130c2acd93d40>
Occupational Dictionary:
<https://www.dpsa.gov.za/dpsa2g/documents/hrp/2021/The%20Public%20Service%20Occupational%20Dictionary.pdf>

4.6 Data analysis

Tracy (2019) described data analysis as an iterative process that alternates between the emergent reading of the data and the use of existing models and theories. I employed an iterative analysis process, as highlighted by Tracy (2019), oscillating between the raw data and existing theories employed by the study. I engaged in both inductive and abductive coding to draw out themes, constantly refining them.

The inductive approach to data analysis plays a vital role in research, as Rosenberg (2020b) highlighted. This approach allows researchers to derive universally applicable conclusions from specific instances. By closely observing and analysing data, researchers can identify patterns and similarities integral to constructing a broader understanding of the subject under study. Rosenberg further emphasises the strength of inductive analysis in guiding empirical generalisations, that it enables researchers to extrapolate findings from the data, leading to the formulation of generalised conclusions that extend beyond the immediate scope of the observed phenomena.

Abductive analysis, on the other hand, offers a complementary perspective. This analytical approach is essential for situating research phenomena within a theoretical or conceptual framework. As Rosenberg (2020b) elucidates, abductive analysis is crucial for understanding and interpreting data within the context of broader theoretical constructs. It aids researchers in ascribing meaning to their findings, not just in the immediate context of the study but also in broader theoretical and conceptual context.

Abductive analysis, therefore, serves as a bridge between empirical observations and theoretical interpretation, facilitating a deeper comprehension of the data and its implications. This allowed me, using SEM for skills and CHAT theoretical frameworks (elaborated in Chapter 3), to weave together observed patterns and theoretical principles, hence enriching the interpretative depth and contextual relevance of the study. This dynamic and reflective approach of employing inductive analysis is used for constructing Chapters 5 and 6 and abductive analysis is employed for constructing Chapter 7. Together this allowed for a nuanced synthesis of data and a deepening of interpretation of emergent patterns, helping to develop a cohesive research narrative and interpretation of findings.

4.6.1 Transcribing process

Transcribing is fundamental in qualitative research, turning spoken words into analysable data (Goertz & Mahoney, 2012). Essentially, it visually represents critical elements of interviews or conversations (Kowal & O'Connell, 2000). I used an audio recorder to capture personal interviews and a focus group discussion in this study. I then employed Otter, an Artificial Intelligence (AI)-driven programme, to transcribe these English audio recordings, especially those from Zoom. To ensure accuracy, given the interviewees' diverse accents, I cross-referenced the AI-generated transcripts while listening to the original recordings, making necessary corrections (Yin, 2018). This process deepened my familiarity with and understanding of the data.

4.6.2 Coding procedure

As Tracy (2019) explained, coding is vital in qualitative research. It serves as the mechanism for organising and categorising data into pertinent categories. Upon preparing and anonymising interview transcripts from May to June 2022, I employed NVivo, a data analysis software, to streamline the coding process. This software offers a methodical approach, particularly suited for the inductive analysis of data, historical analysis of literature and documents, and abductive categorisation and analysis of findings, the approaches I employed.

During the primary-cycle coding, I analysed transcripts to identify themes that aligned directly with my research objectives. This stage is where data is transformed into basic codes, capturing its essence, as Goertz and Mahoney (2012) elaborate. For instance, on reading the data in line

with study objectives, I developed codes such as ‘Farmer needs and extension knowledge’, ‘Extension officer skills, competencies and tasks’, and ‘Extension officer work experiences’. I also developed broader themes in line with the SEM and CHAT theoretical frameworks into codes such as ‘Mediating activity systems actor relationship’, Collaborative horizontalities and horizontal activity systems’, ‘Ecological time’, and ‘Facilitating vertical activity systems and actors’. This broad categorisation of themes was followed by the secondary-cycle coding, a more in-depth analysis phase. Here, initial codes were synthesised and grouped into more specific interpretative categories, occasionally drawing insights from diverse theoretical frameworks for enriched understanding, as Hallier and Forbes (2004) suggested. The broader themes were broken into specific sub-codes. For instance, ‘Extension officer skills, competencies and tasks’ was sub-divided into ‘extension learning and skills’, ‘competencies’, ‘extension work tasks’, and ‘curriculum responsiveness to climate’.

The last phase was conducting axial or hierarchical coding, where I organised these sub-divided codes into a hierarchical scheme, ensuring that they captured all the themes to answer the research question as well as conceptual alignment. Transcripts were then analysed, and data identified to align with the created codes was copied and pasted under suitable codes for further analysis. Any data that did not fall within the created codes was coded separately under emerging themes. Some of the emerging themes included the ‘Use of Information and Communication Technology (ICT) in agriculture’ and ‘Policy influence’. A similar approach was employed in conducting an historical and document analysis in this thesis. This methodical coding approach paved the way for the findings I presented in the subsequent Chapters 5 and 6 and interpreted in Chapter 7. During the data analysis, I always try to observe reflexivity to ensure that in interpreting the findings, my personal opinions or prior knowledge of the subject and contexts did not influence this process.

4.7 Research quality

From a methodological standpoint, ensuring research quality in this study hinged on two pivotal concepts: reliability (or dependability) and validity. Both concepts, essential in qualitative and quantitative research, serve as a basis for achieving findings that are not only accurate and valid but also credible, meaningful, and confirmable. As Patton (2002) emphasised, these measures ensure that the research’s outcomes are rooted in truth, giving them both weight and merit in academic and practical contexts.

4.7.1 Validity

In qualitative research, validity gauges if different researchers, using similar methods, reach consistent interpretations (Franklin & Ballan, 2001). It assesses the accuracy of studying a phenomenon and the appropriateness of employed tools (Creswell & Miller, 2000). The concept is dynamic, potentially shifting based on situational factors and researcher-participant interactions (Patton, 2002). As the researcher reflexively works with the situational factors and researcher-participant interactions, he or she must do so carefully and systematically to ensure trustworthiness and ‘thick descriptions’ of the data. These deepen the validity of qualitative studies. Bashir, Afzal and Azeem (2008) underscored that such an approach can bolster the efficacy and credibility with which research aims are met.

Triangulation in qualitative research is pivotal for capturing diverse realities reliably. Bashir et al. (2008) emphasised that employing data and method triangulation enhances validity, aiding in a more robust construction of reality. In this study, multiple methods, as explained in section 4.6, were used to contribute to a more dependable interpretation. Theoretical triangulation was also employed, leveraging various theories to elucidate the study’s phenomenon. As Bennett (1997) noted, this approach can address questions that might escape a single theoretical lens. Here, the study drew on both the SEM for skills and the CHAT framework (refer to Chapter 3), offering a clear ontological and epistemological stance (section 4.2 of this chapter). Such rigorous methodological and theoretical frameworks, combined with transparent case selection, were employed to enhance the trustworthiness of the findings, potentially allowing for generalisation or adaptability in similar or related contexts. Source triangulation was also employed in historical analysis, as elaborated in section 4.5.1 of this chapter. This was useful in ensuring the credibility of authors and sources and was useful for further strengthening the confidence and robustness of the findings.

4.7.2 Reliability (dependability)

Reliability, or ‘dependability’ as termed by Lincoln and Guba (1985), was crucial in this research. While quantitative research prioritises consistency, qualitative research emphasises understanding and confidence in the study’s design, execution, and analysis (Patton, 2002). Lincoln and Guba (1985) posited that reliability underscores trustworthiness, and researchers can enhance it by mitigating their biases. This study manifested dependability through four

pillars: trustworthiness, confirmability, credibility, and transferability. These pillars are briefly explained below:

Confirmability in qualitative research refers to the attempts at being reflexive and rigorous in presenting findings, aiming to achieve ‘objectivity’ as far as is possible (Seale, 2002). As emphasised by Anney (2014), it entails assessing data to determine if another researcher might arrive at similar conclusions. While recognising that no two contexts are the same, and that a researcher’s subjectivity is always present, this study sought to ensure confirmability through use of detailed analysis procedures, encompassing transcription and coding, delineated in section 4.6 of this chapter, while also recognising that positivist forms of objectivity are not consistent with the epistemic commitments of the study.

Reliability is often linked to credibility and transferability (Finfgeld-Connett, 2010). Credibility pertains to the trustworthiness of the findings. To ensure this, it is imperative to handle data carefully and design the study accurately (Korstjens & Moser, 2018). Credibility was anchored in a cross-case design in this context, as detailed in section 4.3. Additionally, the researcher’s own credibility played a pivotal role. Trust and rapport with participants, attained during interviews and focus groups, facilitated genuine responses. I maintained reflexivity throughout, critically assessing my standpoint, grasp of the study’s context, and its role in relation to the wider VETAfrica 4.0 project. Such awareness allowed me to account for my subjectivity in the research, and to bound the specific focus of my study within a wider research programme.

Transferability in qualitative research implies the potential applicability of study findings to different contexts. It assesses if study outcomes can be generalised or applicable to inform studies elsewhere. This does not assume generalisability as in quantitative research, rather it offers a means for readers to draw insights from the research to other contexts. As Golafshani (2003) posited, this is ascertained through the researcher’s detailed or ‘thick’ descriptions, which allow readers to judge the relevance of the results for uptake and contextualisation to contexts elsewhere. This study used consistent methods and procedures for data collection and analysis, and comprehensive descriptions of the findings were provided to bolster transferability.

4.8 Chapter conclusion

This chapter described the qualitative methodology employed in this research, aiming to clarify the methods undertaken to fulfil the study’s objectives. The research was rooted in the constructivist paradigm and framed within ontological and epistemological stances provided

by the SEM and CHAT theoretical perspectives discussed in Chapter 3. The cross-case approach study's design, informed by historical analysis as well as qualitative analysis from primary sources, helped to shed light on the comparative analyses at both the macro (national) and micro (local) levels between the Alice and Gulu cases to show that skills ecosystems are not only place-based but are also hierarchical across different levels. Various data collection techniques particularly purposive sampling were essential in accessing key informants for interviews in this research. Historical literature and secondary documents such as study curriculum, policies, and labour market information were critical in generating meaningful findings presented in chapter 5 and 6. The Climate Resilience Assessment Tool for analysing study curricula was useful in highlighting the responsiveness of the VET programmes in developing the skills at selected learning institutions, the empirical findings which are described in chapters 5 and 6. NVivo software provided the platform for thematically analysing the transcribed data. Throughout the process this research observed guidelines for quality research, detailing the measures to ensure validity and reliability and underscoring the researcher's commitment to reflexivity throughout the process, given my positionality as a researcher in the VETAfrica 4.0 Collective research programme as elaborated in sections 4.5.1, 4.5.2, 4.6.2 and 4.7.2 of this chapter.

The forthcoming Chapters 5 and 6 of this thesis provide detailed findings from two distinct case studies. Chapter 5 explores the case of Alice in South Africa, and Chapter 6 focuses on Gulu in Uganda. While some aspects might mirror those in Alice, Gulu has unique circumstances.

CHAPTER 5: EXTENSION SKILLS PLANNING AND DEVELOPMENT IN ALICE, SOUTH AFRICA

5.0 Introduction

This chapter presents the findings of Case 1 in Alice, South Africa. In order to contextualise the findings for Chapter 5, an historical review of extension services and other relevant literature on extension services is provided from a national perspective as this influences the particular case, which comes into focus in the latter part of the chapter. In this chapter, I undertook a combined historical analysis and empirical research to understand skills development centering on the agricultural extension occupation and its responsiveness to climate resilience in South Africa and Alice using a SEM for skills perspective. To gain insight into verticalities, mediation institutions and tools, and horizontalities, the methodology encompassed a policy analysis, curriculum review, and the collection of insights from farmers, extension officers, and lecturers at FCAFTI. These findings help to understand the complexities of the skills ecosystem and its ability to respond to climate resilience. It also helped to identify the activity systems and their roles in the SEM for skills, which is further abductively discussed in Chapter 7.

In this chapter, sections 5.2 to 5.3.3 contribute to addressing the first two study objectives: conducting a historical review of occupation as a mediating unit of intervention for skills planning and skills development (objective 1) and examining the current descriptions of the extension occupation (objective 2). Subsequently, the chapter presents the empirical findings of Alice, situated in Alice, South Africa, tackling objectives 3 and 4. These objectives involve examining how VET preparation for extension work takes place in response to the need for climate resilience (objective 3) and reviewing agricultural extension and VET policy and the labour market's responsiveness to climate resilience (objective 4).

The chapter briefly overviews South Africa's agricultural sectoral context in section 5.1 and discusses a historical sociology of the extension officer occupation in sections 5.2 to 5.3.3. This then paves the way for the qualitative contemporary empirical findings in sections 5.4 to 5.6.3. These empirical insights arise from a blend of primary and secondary data, encompassing personal interviews, focus group discussions, and the analysis of various tools and frameworks, such as the Climate Resilience Assessment Tool, the occupational classification framework

and labour market information. The chapter thus balances historical context with contemporary insights to shed light on the agricultural landscape and the nature of extension officer occupation in South Africa. The following section is an overview of South Africa's agricultural sector.

5.1 A brief overview of South Africa's agricultural sector

South Africa's agricultural sector, a critical component of its economic and social fabric, is grappling with significant challenges exacerbated by climate change. The sector, which encompasses commercial and smallholder farming, is pivotal in the nation's economic landscape. According to Statistics South Africa (2018), there are over 42 000 commercial farmers utilising 46.4 million hectares which constitutes 37.9% of the country's total arable land and these farmers produce 80% of the agricultural output.

The sector also comprises many smallholder farmers, predominantly Black, who contribute between 5-10% of the total agricultural output. Despite their considerable presence, estimated at over 2.3 million by Statistics South Africa (2016), these farmers have historically been marginalised, and their contribution has remained relatively unchanged over the last two decades (Sihlobo & Kirsten, 2021). This disparity highlights the deep-seated structural issues within South Africa's agricultural sector, which need urgent redress.

Nonetheless, the role of agriculture in South Africa extends beyond mere food production; it is observed as crucial in economic development and structural transformation, such as inducing industrial growth, increased food supply, acting as a market for industrial output and increased foreign exchange earnings (Sihlobo & Kirsten, 2021). This aligns with Byerlee, De Janvry and Sadoulet's (2009) previous observation that agriculture has multiple functions for development in South Africa, including reducing poverty, spurring economic growth, and delivering environmental services. This potential can be seen in recent statistics. For instance, in the 2021 financial year, agriculture contributed 10% to South Africa's economy at a value of US\$12 billion, with the largest exports by value being citrus, wine, table grapes, corn, apples, pears, and wool (Statistics South Africa, 2021).

Despite its potential, the sector faces significant challenges, primarily due to prolonged droughts and other impacts of climate change. A noticeable decline in the agricultural sector's performance for commercial and smallholder farmers has been exacerbated by climate change (Sihlobo & Kirsten, 2021). Between 2007 and 2018, commercial agricultural employment

decreased by 1.6% from 769 594 (Statistics South Africa, 2020), and the number of smallholder farmers reduced by 5% between 2011 and 2016 from 2.88 million to 2.33 million (Statistics South Africa, 2016). South Africa's semi-arid climate and water stress further compound these challenges, with only a fifth of the land deemed suitable for high-quality agriculture (World Bank, 2021a).

The reliance on agricultural extension services to enhance productivity among the millions of smallholders in South Africa is critical. However, the AgriSETA Skills Sector Plan (SSP) Report (2020) underscores a scarcity of agricultural extension officers, with a high officer-farmer ratio of 1:1053. This scarcity is concerning, especially considering the crucial role of extension services in facilitating smallholder farmers' adaptation to climate change. The Department of Agriculture, Land Reform and Rural Development [DALRRD] (2021) and Von Maltitz et al. (2023) have indicated that the public criticises extension services for being ineffective, and staff are seen as lacking control over critical aspects such as climate change and deteriorating natural resources.

To address these challenges, there is a pressing need to bolster technical knowledge, redefine extension services, and foster entrepreneurial skills tailored to the evolving climate challenges in agriculture (AgriSETA, 2020). Sihlobo and Kirsten (2021) emphasised the poor coordination between government, private sector, and NGOs in the agricultural sector, limiting its potential to reach full productivity. Addressing these skills gaps and coordination issues is crucial for revitalising South Africa's agricultural sector, considering its multifaceted role in the nation's economy and societal development. As climate change continues to impact the agricultural landscape, a concerted effort from all stakeholders is essential to ensure the sustainability and growth of this vital sector.

5.2 The history and development of extension services in South Africa

The history of extension services in South Africa is deeply intertwined with its socio-political landscape, especially changes in land tenure. Before the European settlers' arrival, indigenous tribes like the Khoi, San, Xhosa, and Zulu held the land through customary tenure systems (Mamdani, 1996; Ngam, 2021). This paradigm shifted in 1652 with the Dutch East India Company initiating the first phase of land dispossession, which continued into the apartheid era. This marked the start of three centuries where European settlers, especially the Dutch, sought to replace the African customary tenure with their own freehold system (Ngam, 2021).

This land-grabbing, fuelled by discriminatory policies, benefitted White communities at the expense of Black African smallholders and some Indian farmers (Amoateng & Ritcher, 2007) over a 300-year period.

Until 1925, there was no formalised agricultural extension service in South Africa. Black farmers relied on indigenous knowledge for cultivation, whereas White immigrant farmers, mainly the Dutch and later some French and English settlers, practised European farming methods (Beinart & Coates, 2002; Mosley, 1982). The push for a structured agricultural extension emerged due to a growing population in mining towns and other regions, necessitating improved farming techniques (Mushangai, 2020). Secondly, the financial struggles of White and Dutch farmers were demonstrated by the frequent bankruptcies of institutions such as the Natal Land and Colonisation Company, which used to finance White farmers (Slater, 1975). The third reason concerned the socio-economic impact of the first and second Anglo-Boer wars, with the latter from 1899-1902 severely affecting the nation's economy, mainly due to Lord Kitchener's destructive scorched earth warfare strategies (Jewell, 2003). After the second war, the focus shifted to economic reconstruction, with the then High Commissioner and Governor of South Africa, Governor Alfred Milner, emphasising the revitalisation of the agricultural sector (Jones & Garforth, 1997).

After the Anglo-Boer wars, South Africa's rejuvenation of its agricultural sector faced significant challenges, primarily due to a scarcity of skilled agricultural experts (Liebenberg, 2015). To counteract this, the country turned to Europe in the 1880s, importing specialist extension officers, leveraging the strong ties of White South African farmers with the European continent, where agricultural extension was gaining traction (Jones & Garforth, 1997). By 1925, the need for a structured approach led General Kemp, the then Minister of Agriculture, to formalise these services, establishing the Extension Service Division under Col. Heinrich du Toit's leadership within the Department of Agriculture (Terblanche, 2013). This move paralleled the enactment of the 1936 Land Act, aiming to embed European-style land tenure systems. However, the foreign extensionists found the unique South African agricultural landscape challenging (Liebenberg, 2015). Despite efforts to expand services and educate more extension professionals, the system, which was still trying to find its footing, faced hurdles like the 1930s drought and the implications of World War II (Terblanche, 2013). Outside the World War II sphere were internal ethnic hostilities from social, economic and political splits emanating from segregationist colonial policies. In response to a challenging political and

economic landscape, Black farmers in South Africa felt compelled to create distinct extension pathways that were rooted in indigenous knowledge, diverging from those of the White farmers (Koch & Terblanché, 2013). A parallel response was also evident among the Indian community, who, similar to the Blacks, established their own separate extension services (Liebenberg, 2015). The following section explores the historical context of agriculture and extension services in South Africa during the colonialism and apartheid eras leading up to the nation's independence.

5.2.1 Agriculture and extension in pre-independence South Africa

Before achieving independence, South Africa's agricultural systems, including extension services, were deeply influenced by the colonial state's socio-political and economic alterations, leading to the widespread marginalisation of Black populations. As Murray and Williams (1994) detailed, the colonial governance approach unfolded in three phases. Initially, land acquisition took centre stage, serving as the foundation for subsequent socio-political and economic transformations. The second phase was characterised by the colonial state introducing Western institutions, such as the judicial system and property rights, facilitating land expropriation. Ultimately, the third phase saw the restructuring of the communal systems intrinsic to Black African communities. By transitioning to legally structured dispossession methods rather than overt force, the 1906 Makiwane Court ruling marked a significant departure from earlier tactics (Murray & Williams, 1994). Building on this framework, Hall (2004) observed that the colonial government actively utilised discriminatory land and market policies, sidelining Black farmers to ensure the growth and protection of White commercial farming. Hebinck (2014) further emphasised how these policies, underpinned by racial prejudice, laid the groundwork for broader segregation in land ownership, property rights, and organised market activities. Thus, as Maqwelane (2021, p. 11) noted, land and market access evolved into potent tools in the colonial arsenal, ensuring the ongoing economic and political sidelining of Black farmers and aiding the rise of the "early forms of agricultural commodity production".

The colonial-era legislative measures consolidated land rights, primarily favouring White populations and institutionalising the marginalisation of Black communities in agricultural practices. Hebinck (2014) pinpointed the Fencing Act (1883-1910) and the 1894 Glen Grey Act as instruments setting the first two stages of land appropriation in motion. While the former laid the groundwork for White land rights, the latter extended to codify the rights of 'others',

accelerating both land rights establishment and subsequent commodification in rural regions (Hebinck, 2014). In a striking demonstration of this systemic inequality, Mamdani (1996) highlighted that the South African Land Law of 1913 allowed peasants access to a meagre 7.13% of the land, which was subsequently increased to 14.26% with the Native Trust and Land Act of 1936. The underlying premise of the latter legislation was an attempt to anchor land in “customary possession” (Mamdani, 1996, p.143). Central to the 1913 Natives Act was the forced eviction of Africans, with land governance under the Native Land Authority structure where tribal chiefs acted as intermediaries between their communities and the government, their authority reinforced by customary law (Mamdani, 1996).

The regime, understanding that customary land access could afford the peasantry some self-production autonomy, sought to curtail this freedom (Mamdani, 1996). As a result, market forces began to influence productive activities on customary land, further constraining the peasantry. This exclusion from actively participating in agriculture was expressly reserved for Black farmers through the Agricultural Development Acts of 1904-1907. These acts bolstered White commercial farming by extending financial assistance, mainly from the Land and Agricultural Bank established in 1912, ensuring its sustained growth (Hall, 2004; Maqwelane, 2021). Meanwhile, the 1913 Native Land Act further curtailed Black farming activities, restricting new farming ventures, land purchases, sharecropping, and cash rentals on lands owned by Whites (Hall & Kepe, 2017). This legislative process stifled Black agricultural activities and undermined their economic agency, ultimately transforming homelands into collections of inexpensive African labour (Binswanger & Deininger, 1993).

The enactment of the 1936 Land Act was a pivotal instrument for pushing Black populations into Bantustans and forcing them into wage labour, strategically weakening Black agriculture (Bundy, 1979). This was bolstered by the Marketing Act of 1937, which monopolised the export market, further protecting the interests of White commercial farming (William et al., 1998). Simultaneously, as Indian farmers began thriving in the Natal province, their growth was frustrated by the 1946 Asiatic Land Tenure and Indian Representation Bill. This legislation prohibited interracial property dealings, hindering the largely lease-dependent expansion of Indian farms (Koch & Terblanché, 2013). These successive and strategic legislative moves, crafted in the colonial era, redefined South Africa’s agricultural dynamics and fundamentally impacted the country’s agricultural extension services, perpetuating racial imbalances in the sector.

In response to the sustained sidelining of Black farmers, the Tomlinson Commission of Enquiry was instituted in 1950, aiming to uplift Black farmers in homelands (Mamdani, 1996). While the 1955 Commission recommended granting freehold land tenure to Africans with developmental prerequisites, the colonial administration dismissed this (Mamdani, 1996). This refusal cemented a tenurial duality: while commercial agriculture continued to operate under freehold or extended leasehold systems, subsistence farming remained anchored in communal and customary land (Bruce, 1986). This dichotomy is still evident today, characterising the history of the Alice case. The colonial regime's protective measures protected White export farming by prohibiting Black farmers from cultivating cash crops. However, as independence approached, such constraints were relaxed. With the inception of the Farmer Support Programme by the Development Bank of Southern Africa (DBSA), the capital was channelled into Black agriculture, promoting a synergy of "extension, training, infrastructure, and marketing support" (Hall, 2004, p. 8). Many of these Black beneficiaries diversified income streams to strengthen their farming activities. As independence came closer, the upcoming government prioritised broad ranging land and agrarian reforms, aiming to uplift Black smallholders, as discussed in the following section.

5.2.2 Agricultural extension in post-independence South Africa

As the political landscape in South Africa started shifting towards democracy in the late 1980s and early 1990s, land reform and the necessity for agricultural reform took centre stage. After independence, the democratically elected African National Congress (ANC) government attempted to democratise traditional decentralised authorities and undo the effects of apartheid (Mamdani, 1996). The new government understood that pivotal to undoing the colonial and apartheid damage was strengthening property rights and ending a discriminatory "buying power and collective bargaining of established agri-business and cooperatives of white farmers" (James, 2011, p.137). This step required comprehensive government action, which compelled it to pilot several policies and development programmes explored below.

The Settlement and Land Acquisition Grant (SLAG) was the first major land reform. In 1997, under President Nelson Mandela's leadership, the Department of Land Affairs (DLA) introduced the Settlement and Land Acquisition Grant (SLAG). This initiative aimed to assist households financially, offering up to R15 000 to procure land from White owners for both residential and agricultural purposes. The approach adopted was based on a "market-based willing buyer-willing seller" model (Ngam, 2021, p.136). However, this method soon showed

its limitations due to its immense financial demands. Hall (2004) pinpointed the inadequacy of the provided funds for successful land and agricultural development. Furthermore, escalating market prices exacerbated the challenge, rendering the acquisition process increasingly unattainable.

In response to the challenges faced under the Settlement and Land Acquisition Grant, the South African government shifted focus and opted for the Reconstruction and Development Programme (RDP). This policy framework was designed primarily to alleviate poverty among Black South Africans. Central to the RDP was the ambition to overhaul the agricultural sector, making it more inclusive, enhancing extension support, training, and increasing access to land (Nel & Davies, 1999; Maqwelane, 2021). To achieve this vision, the White Paper on Agriculture was formulated in 1995, laying out specific goals:

1. Transitioning towards a market-oriented commercial farming ecosystem, prioritising family farms as its cornerstone.
2. Expanding accessibility to agriculture by implementing land reform, anchored by suitable policy tools and the provision of appropriate services.
3. Ensuring that the financial system focuses on supporting resource-limited and emerging farmers to empower them to acquire land and essential agricultural inputs.
4. Encouraging agricultural trade and marketing, mirroring market trends and demands.
5. Committing to agricultural methods that respect and preserve natural resources, including water.
6. Stressing the significance of agriculture in shaping the regional development of South Africa and the neighbouring countries in Southern Africa.

The South African Agricultural White Paper, formulated in 1995, aimed to overhaul the existing extension services framework to better support Black farmers. Recognising the success of extension services in commercial agriculture and their lack of effectiveness in self-governing territories, the policy advocated for an integrated approach tailored to meet the needs of Black farmers in reserves. Instead of perpetuating the traditional transfer-of-technology model, the White Paper pushed for a participatory one. Here, extension officers would undergo training to serve as facilitators, fostering active participation from farmers (Department of Agriculture, 1995).

Besides emphasising the integration of research capabilities in extension, the policy also underscored the significance of cohesive efforts across government programmes, training institutions, and resource allocation. Additionally, the policy acknowledged environmental challenges such as drought, ecological degradation, and the adverse impacts of excessive pesticide and fertiliser usage. Despite this recognition, Maqwelane (2021) noted that the policy had shortcomings in formulating comprehensive measures to address these challenges within the agricultural extension strategy. While the White Paper notably concentrated on land reform, farm production, and market access, it can be argued that some policy decisions during this period were experimental.

Subsequently, in 1995, South Africa launched the Land Reform Pilot Programme (LRPP), focusing on the provinces of Northwest and Mpumalanga with the primary goal of politically empowering rural, landless women via land reform and rural development initiatives (Hargreaves, 1996). However, the programme's ambitious aspirations were short-lived. Bernstein and Byres (2001) highlighted the initiative's downfall to its misalignment with market-oriented reforms and the government's interventionist approach that failed to resonate with the genuine needs of rural communities. Learning from LRPP's setbacks, the South African government afterwards initiated the Growth Employment and Redistribution (GEAR) strategy. With a stronger leaning towards market-oriented dynamics, GEAR sought to forge "efficient and competitive family farms" (Maqwelane, 2021, p. 15).

Nevertheless, this, too, had its own setbacks. Hall (2011) critiqued the strategy for exacerbating existing land relations and being ineffective in overhauling landholding rights. Additionally, withdrawing subsidies for White farmers within the GEAR framework led to a significant reduction in agricultural employment, steering the sector to become more capital-intensive.

In 2001, under Thabo Mbeki's leadership, South Africa introduced the Land Redistribution for Agricultural Development (LRAD) programme, an initiative designed to secure land predominantly for agricultural activities, overseen by the Land Redistribution for Settlement Grant (Ngam, 2021). This approach enabled the joint acquisition and subdivision of larger chunks of land into more manageable production units among smaller-scale farmers and farm workers (Bannister, 2003). However, the programme was short-lived due to underfunding, with Black South Africans having acquired a mere four million hectares by 2005 (Ngam, 2021).

This setback led to the launch of the Proactive Land Acquisition Strategy (PLAS) in 2005, focusing on securing strategically located, resource-rich land within agricultural corridors and nodal areas (DARDLR, 2015). Although the programme initially indicated promise by leasing acquired land to emerging Black farmers, the momentum diminished following leadership changes in the government. The programme's attention waned during Motlanthe's interim presidency, and subsequent underinvestment during Zuma's tenure in 2009 led to dropping enthusiasm from landowners, stalling further land acquisitions (Ngam, 2021).

Introduced under President Mbeki in 2004, the Comprehensive Agricultural Support Programme (CASP) was designed to bolster food security and agricultural development, operating within the confines of the Integrated Sustainable Rural Development Strategy (ISRDS) and Integrated Food Security Strategy (IFSS). Targeting four distinct groups, namely the hungry and vulnerable, subsistence farmers, land reform beneficiaries, and the broader agricultural macro system, the programme's six pillars centred around knowledge dissemination, technical aid, capacity building, infrastructural investment, market growth, and financial support. The programme's technical component offered extension training support and mentorship and prioritised women and youth, farm workers and groups and cooperatives to use the provided financial assistance to boost agricultural output through mechanisation, irrigation schemes and inputs (DALRRD, n.d.). Despite its clear objectives, CASP faced implementation hurdles, resulting in farmers in some provinces being left without assistance for extended periods (Ngam, 2021).

Tackling the broader land reform discourse, Cousins (2007) argued that governmental interventions often overlooked the significant impediments posed by traditional authorities. Following the dissolution of the Bantustans, attempts to democratise traditional councils, such as through the 2003 Traditional Leadership and Governance Framework (TLGF) Act, retained the chief's control over land. This perpetuated existing inequalities and seemed to replicate the apartheid-era homeland demarcations (Cousins, 2007). Despite initial moves to empower individuals living under customary authorities, the government's approach was critiqued for maintaining the dominance of traditional authorities (Friedman, 2021). Legislative measures like the Communal Land Rights Bill (CLRB) were even declared unconstitutional in 2009 due to infringing on individuals' rights. Such complexities have constrained agricultural progress in rural sectors and affected the effectiveness of extension services.

In the overarching land reform and agricultural development debate, Friedman (2021) perceived the proposals surrounding land appropriation without compensation as potentially more racially motivated than agriculturally centred. The land discourse in South Africa remains multifaceted, profoundly influencing the nation's agricultural trajectory. In the subsequent section, I discuss the evolution and professionalisation of extension education within South Africa.

5.2.3 Extension education and professionalisation

The origins of extension and agricultural education in South Africa can be traced back to the early 20th century when agricultural schools were initiated to nurture expertise in the agricultural sector. A few institutions were established including Teko Agricultural School in 1905 and the Grootfontein College of Agriculture (later known as Grootfontein Agricultural Development Institute) in 1911 (Coetzee, 1987). These colleges aimed to train agricultural extension officers to serve primarily White South African farmers. Further additions to these educational institutions were the Fort Cox Agricultural College in 1936 in the Eastern Cape and Tompi Seleka Agricultural College and a college at Taung in 1960 and 1965, respectively (Liebenberg, 2015). After these, many other colleges were established. Whereas these colleges played roles in areas like crop demonstrations and fertiliser trials, they faced challenges like insufficient infrastructure and limited staff. Additionally, a significant racial disparity prevailed: most graduates were White, serving predominantly White farmers. The colonial regime, wanting to limit job competition between Black and White graduates, contended that Blacks, having worked on White farms, did not require formal agricultural extension education. Consequently, Black communities received a separate 'Bantu' education (Coetzee, 1987; Showers, 2010).

As earlier mentioned in preceding sections, the Indian community in South Africa was similarly subjected to discrimination in agricultural development. They, too, took the initiative to establish their own agricultural education and extension services. Predominantly located in the KwaZulu-Natal (KZN) province and largely focusing on sugarcane cultivation, this separate development stemmed from the Indian community's settlement patterns, distinct from the White settlers (Liebenberg, 2015). Dr J A Pentz was a notable figure in spearheading extension work within the Indian community, emphasising both production augmentation and resource conservation. Due to the growing need for specialised extension services, Cedara

Agricultural College introduced a three-year diploma course in extension to cater to this demand (Liebenberg, 2015).

With a growing number of agricultural extension agents and a growing interest in the profession, South African tertiary institutions began to further develop extension officers' training and research capabilities. In 1926, the University of Stellenbosch marked the commencement of this trend by establishing the country's first Department of Agricultural Economics, shortly after the Division of Extension Services was integrated into the Department of Agriculture (Koch & Terblanché, 2013). By the 1950s, the University of Pretoria had not only inaugurated an agricultural extension-focused research facility but also, by 1959, introduced the Department of Agrarian Extension. This latter department evolved into today's Department of Agricultural Economics, Extension and Rural Development, and began admitting postgraduate students. The trend continued with institutions like the University of Limpopo, University of KwaZulu-Natal, Tshwane University of Technology, University of Northwest, Cape Peninsula University of Technology, and the University of Venda offering extension education (Terblanché, 2013).

Recognising the expansion and importance of the field, professionals and stakeholders resolved to establish the South African Institute for Agricultural Extension (SAIEX) in 1966, later rebranded as the South African Society for Agricultural Extension (SASAE) in 1979 (Koch, 2007). This pivotal organisation, championing the advancement and professionalisation of extensionists, plays a central role in refining standards, practices, and curricula for the profession. Representing over 1200 members, the majority being government employees and a few from the private cooperative sector, SASAE embodies the spirit of evolving agricultural practices underpinned by rigorous research and rich experience (SASAE, n.d).

Presently, South Africa has made strides in the professionalisation and accreditation of professions and occupations, including agricultural occupations such as 'extension officer'. The Department of Agriculture formulated the Norms and Standards for Agricultural Extension, describing the imperative of enhancing the system while also stipulating the essential competencies and skills required of extension personnel (Davis & Terblanche, 2017). Furthermore, the country has enacted the Natural Scientific Professions Act (Act No. 27 of 2003), which mandates all scientists, including extension professionals, to register

within distinct fields of practice and categories with the South African Council for Natural Scientific Professions (SACNASP).

An individual appointed as an extension officer or advisor is expected to possess an Advanced Diploma in Agriculture qualification (aligned with the National Qualification Framework [NQF] level 7) and must hold registration with an acknowledged professional entity (refer to Chapter 5.6.3). The South African Society for Agricultural Extension (SASAE) serves as the collective platform for extension professionals within South Africa and operates under the oversight of the SACNASP (SASAE, n.d.). The divergent prerequisites for registration under SACNASP and SASAE for extension scientists are outlined in Table 5.1 below.

Table 5.1. Extension scientists’ requirements for accreditation in South

Membership category	Description
Professional Extension Scientist	Extension or equivalent postgraduate extension qualification; 120 credits in extension at Masters/PhD level and 4 years of post-qualification work experience
Candidate Extension Scientist	A person with qualifications as a Professional Extension scientist but with 3 years’ work experience
Certified Extension Technologist Level A	Minimum 3-year BSc Agric degree/National Diploma or Advanced Diploma within extension or equivalent qualification with 60-119 extension credits. 3 years of experience in extension
Candidate Extension Technologist Level A	Same qualifications as Certified Extensionist Technologist Level A But less than 3 years’ work experience in extension
Certified Extension Technologist Level B	Minimum 3-year BSc Agric degree/National Diploma or Advanced Diploma within extension or equivalent qualification with 10-59 extension credits. 3 years of experience in extension
Candidate Extension Technologist Level B	Same qualifications as Certified Extensionist Technologist Level B But less than 3 years’ work experience in extension
Associate Extension Technologist	No formal qualifications but with at least 10 years of experience in extension with one independent witness

Source: <https://sasae.co.za/membership-new>

The following section explores the challenges facing agricultural extension and the sector in South Africa.

5.3 Constraints of agriculture and extension services in South Africa

The agricultural sector of South Africa faces an array of challenges and risks that necessitate the adoption of novel skills and approaches. As highlighted by South Africa's Agricultural Sector Education and Training Authority (AgriSETA), the escalating challenges and vulnerabilities confronting the agricultural sector have prompted a review of existing occupational provisioning within skills planning and development. The evolving landscape necessitates the cultivation of new skills and proficiency to effectively address the emerging demands of farmers (AgriSETA, 2021).

At a broader level, the agricultural sector and extension services in South Africa are grappling with complex challenges encompassing resource scarcity, a lack of political will and inadequate capacity for formulating and executing extension-friendly policies (MacLeod, McDonald & Van Oudtshoorn, 2008), alongside deficient basic infrastructure, encompassing both physical and Information Communication and Technology (ICT) resources (Mabe, 2012). The limited resource allocation for extension officers has constrained their effectiveness in engaging with the growing number of emerging farmers, a challenge exacerbated by the high extension officer-farmer ratio (MacLeod et al., 2008), which the Department of Agriculture, Land Reform and Rural Development (2021) indicates currently stands at 1:1053.

Also, South Africa's extension services confront a shortage of professional extension agents. Davis and Terblanche (2016) revealed that as of 2007, approximately 80% of extension agents in South Africa held academic qualifications at the diploma level or below, despite the national norms and standards mandating a degree qualification. This discrepancy has drawn the government's attention towards enhancing the skill set of extension officers. A report by the Department of Agriculture, Forestry, and Fisheries (2009) advocated for the Directorate of Education, Training, and Extension, along with other relevant entities, to facilitate the annual enrolment of extension officers in skills upgrading programmes over the medium term.

Developing effective planning strategies for extension officers in South Africa is complex and necessitates thorough consideration of the nation's dichotomous agricultural landscape. The distinct segments comprising commercial and subsistence farmers give rise to divergent needs. For instance, addressing the requirements of commercial farmers mandates the provision of elevated technical proficiencies to support their managerial roles, enhanced agricultural education and training, and the implementation of Recognition of Prior Learning (RPL)

programmes to empower their less skilled labour force (AgriSETA, 2020). Conversely, extension officers engaging with smallholder farmers must possess a collection of rural development skills and competencies to uplift livelihoods and enhance food security (AgriSETA, 2021). This intricate scenario is further underscored by the following discussion on the key catalysts driving these challenges, necessitating the cultivation of novel and innovative skills within South Africa's extension services.

5.3.1 Risks from climate change

South Africa's agricultural sector confronts its most significant challenge in the form of climate risks. The report by the United States Agency for International Development (USAID, 2018) elucidates that climate-related threats pose a substantial peril to the nation's agriculture, manifested through escalating temperatures, erratic rainfall patterns, and intensified extreme weather events. The National Planning Commission's (2012) report states that climate change ramifications, such as droughts and flooding, can diminish food production and water availability and heighten the risk of migration conflict. The impact of climate change on water resources holds considerable significance, particularly considering that agricultural activities in South Africa consume a substantial portion of the nation's water supply. Specifically, agricultural practices account for 65% of the country's available water resources, with irrigation agriculture alone utilising 60% of this total (BIGNAUT & VAN DER ELST, 2009).

The World Bank has identified floods, droughts, and wildfires as the principal catalysts of climate-induced consequences in South Africa. Moreover, the World Bank's findings highlight that drought, in isolation, impacted approximately 15 million South Africans between 1980 and 2013 (World Bank, 2021a). The report additionally highlights the Western Cape's encounter with its most severe drought in over a century, substantially curbing water availability and impeding advancements across agriculture and various sectors. These climate-induced effects have heightened the conflict between agricultural and livestock needs, especially during dry periods (USAID, 2018). Crop yields face reduction, growing seasons could shift, and unpredictable rainfall and wildfires may become more frequent due to increased water stress and rising temperatures (World Bank, 2021a). The World Bank has further asserted that climate impacts, especially on water resources, agriculture, and food security, disproportionately affect poor rural smallholder farmers.

An integrated climate adaptation approach is recommended by USAID, emphasising the local and municipal levels, given the noticeable absence of personnel equipped with climate change knowledge. One example of adaptation is rainwater harvesting and conservation among smallholders to contribute to consistent food production for both consumption and sale (Lotz-Sisitka et al., 2021). Agricultural extension officers, the intermediaries between farmers and sustainable practices, play a pivotal role in the climate adaptation journey, especially since, as per the World Bank, the chief impediments to adaptation are the deteriorating extension network and the slow uptake of climate-smart agriculture (World Bank, 2021a). AgriSETA (2021) has identified climate change as a catalyst for skills development in various sub-sectors, including horticulture and animal feed. The organisation promotes the infusion of green skills in sustainable farming, highlighting energy-efficient techniques, effective land use, and resource optimisation (AgriSETA, 2021). New roles like conservation officers and agricultural scientists emerge in this context, closely linked with extension officers' duties. Central to this study is the reconceptualisation of the extension occupation, focusing on how extension officers can bolster smallholder farmers' resilience against the changing climate.

5.3.2 Limited knowledge of and access to advanced technology

The rise in technological innovations has become a defining factor for transformation in sub-sector such as grains, cereals, sugar, and tobacco. However, despite the potential benefits, many farmers and extension officers still grapple with inadequate knowledge and limited access to these technologies (AgriSETA, 2021). This technological evolution underscores the demand for research, innovation, and data analytics skills. Further complicating the situation was the Covid-19 pandemic, which disrupted agricultural activities and heightened the urgency to incorporate technology comprehensively. A departure from traditional farmer markets, technology has emerged as pivotal for marketing agricultural produce. This assertion is substantiated by a recent AgriSETA study revealing that 56% of respondents faced challenges in marketing their produce both locally and internationally (AgriSETA, 2020). Technology extends to its role in addressing challenges such as climate change. Emphasising this, the World Bank (2021a) has recommended that the South African agricultural sector and extension services employ technological innovations to engineer crop varieties that can withstand drought conditions. However, not enough is said about the digital divide in relation to such recommendations especially as these intersect with other inequalities.

5.3.3 Population growth

South Africa's rising youth demographic significantly influences the country's skills development landscape, particularly within the agricultural sector. Data from Stats SA (2023) illustrates the youth's challenges, with unemployment rates, stating that by September 2023, there were about 10.2 million youth between the age of 15 and 24, of which 32,7% were unemployed and not in education or any form of training.

Additionally, there is an alarming rise in graduate unemployment. The 2030 National Development Plan (NDP) envisions agriculture as a potential solution, anticipating creating over a million new jobs in the sector by 2030. The NDP has highlighted key areas for development, such as expanding irrigated agriculture, optimising land in communal areas for commercial production, and supporting high-potential agricultural sectors and regions. While most of these proposed measures target commercial farmers, increasing youth participation in agriculture implies a growing need for training and skill development. As young people venture into agriculture, either as emerging farmers or as employees in various sub-sectors, there is a pressing demand for modern agricultural extension services. These services are instrumental in equipping the youth with skills in sustainable production and innovation. Hence, extension officers should be proficient in sustainability and be prepared to deliver the sector's required skills (Rosenberg, 2020a).

In the subsequent sections of this chapter, empirical findings for the Alice case are presented, commencing from section 5.4.

5.4 Empirical findings for Case 1 (Alice)

In this section, the focus is addressing study objectives 3 and 4. These objectives involve examining how VET preparation for extension work takes place in response to climate resilience (objective 3) and the extension and VET policy and labour market's responsiveness to climate resilience responsiveness to climate resilience (objective 4). The subsequent section, 5.4.1, introduces Case 1 in Alice, South Africa. Moving forward, sections 5.5 to 5.5.4 provide empirical insights into VET preparation for extension work. This is achieved by analysing the curriculum document, the Climate Resilience Assessment Tool and conducting interviews with lecturers and extension officers, offering valuable perspectives on their experience and work-related activities concerning climate (especially their mediating roles in the SEM for skills).

Sections 5.6 to 5.6.3 cover labour market information and occupational classification frameworks and VET and extension policies (verticalities in the SEM for skills). The insights were enriched by analysing labour market data and occupational classification frameworks. To gain perspective on horizontalities, farmers were interviewed and observations were conducted on selected farms.

5.4.1 Case introduction

Case study 1 is situated in Alice town and its surrounding rural areas within the Raymond Mhlaba municipality, located in the Amathole district of the Eastern Cape province in South Africa. This province is primarily rural and encompasses former rural homelands, representing a continuation of existing marginalisation and poverty (Lotz-Sisitka & McGrath, 2023). The area's racial composition predominantly consists of Black individuals (92.7%), followed by Coloured (6%), while Whites and Asian/Indian people make up the remaining 2%. The dependency ratio on government social grants in this region is 53.2%, and households have an average size of 3.9 persons (Statistics South Africa, 2016). Alice faces limited economic prospects, and most of its rural population engages in smallholder farming. The area has an estimated population of 159 515 individuals residing in 41 022 households, with 25.6% engaged in agricultural activities (Statistics South Africa, 2016). Historically, this region was part of the former homelands under the apartheid government's segregationist policies, resulting in underdevelopment, pervasive poverty, and restricted employment opportunities (Westaway, 2012).

Given its predominantly smallholder nature, farmers in this area confront significant climate-related challenges such as drought and water scarcity, which adversely impact food security. The region receives minimal rainfall, contributing to below-average annual precipitation levels (DAFF, 2018). Despite contributing only 3% to the local economy, smallholder farming remains a primary source of household sustenance for many residents (Lotz-Sisitka et al., 2018; Westaway, 2012). Key commercial farming activities in the area include citrus production and game farming. Additionally, smaller-scale practices such as poultry, livestock rearing, vegetable cultivation, and mixed farming are also observed (Lotz-Sisitka et al., 2018).

Given this context, agricultural extension and advisory services are vital in supporting small-scale farmers in this area. The Amanzi [water] for Food project identified this location as grappling with underdeveloped small-scale farming, poverty, and water scarcity (Lotz-Sisitka

et al., 2018). Notably, this case is one of the three explored in the VETAfrica 4.0 project, where I participated as a researcher. I selected this case due to my familiarity with the context. The primary VET College for Agriculture training extension officers in Alice is the Fort Cox Agriculture and Forestry Training Institute (FCAFTI). Despite its intended role of producing labour for the local market, such as extension officers to support rural smallholders, FCAFTI's study programmes are mono-crop and industry-oriented, failing to address the community's needs (Lotz-Sisitka & McGrath, 2023). Established in 1930, FCAFTI holds significant historical, socio-economic, and educational importance for Alice and the Eastern Cape province. The Institute boasts extensive crop and pasture lands and is located near Zanyokwe Irrigation Schemes, Amatole Forestry Company, Riverside Citrus Farms, and other large-scale dairy and piggery farms. Offering qualifications accredited by the Council for Higher Education (CHE) at National Qualifications Framework⁶ (NQF) level 6, FCAFTI provides a Diploma in Agriculture and another in Forestry. It stands as one of the 11 agricultural training institutions in South Africa (FCAFTI, 2021) and is the sole institution offering a forestry specialisation. The three-year Diploma in Agriculture programme at FCAFTI primarily delivers extension education through crop production, animal production, and agribusiness specialisations. This vocationally oriented programme combines practical and theoretical instruction, supplemented by six months of work-integrated learning in the final year (FCAFTI, 2021). This study analysed the curriculum of the Diploma in Agriculture programme at FCAFTI to discern how it addresses climate resilience, utilising both secondary and primary data sources.

5.5 VET preparation for extension work concerning climate resilience

This section unveils findings pertaining to the third study objective, outlined in section 5.4 of this chapter and section 1.3 of Chapter 1, which investigates how VET prepares for extension work concerning climate change. A detailed review of the curriculum for the Diploma in Agriculture at FCAFTI is provided in section 5.5.1. This review seeks to determine the integration of climate change themes within the study content.

⁶ The National Qualifications Framework for South Africa is a system that records the credits assigned to each level of learning achievement to ensure that the skills and knowledge that have been learnt are recognised throughout the country. The oversight of the NQF is conducted by the South African Qualifications Authority (SAQA). Read more about NQF and SAQA here: <https://www.saqa.org.za/about-saqa/>

5.5.1 Examination of the curriculum document for climate change content

The analysis involved thoroughly reviewing the curriculum documents for each of the three distinct specialisations within the Diploma in Agriculture programme: crop production, animal production, and agribusiness. The entire programme comprises 25 course units, distributed across the specialisations as follows: agribusiness contains 10 course units, crop production has six, while animal production consists of nine course units. These distributions are further detailed in Table 5.2.

Table 5.2. Curriculum course content pertaining to climate change-related topics

Course specialisation	Course content	
	Course unit	Environment or climate resilience related theme
Animal production	Introduction to Animal Production	Adaptation of animals not different environments
	Beef production	Concepts and practices underlying beef production while conserving natural resources
	Diary production	
	Pig production	
	Poultry production	Influences of environmental and genetic factors on production
	Animal diseases	
	agricultural biology	Population and community ecology, ecosystem, biomes, and biosphere
	Animal anatomy and physiology	
	Small stock production	Production stages and adaptation to different environments
Crop production (horticulture)	Horticultural principles and practices	Environmental factors and horticultural plants, irrigation
	Fruit production	Climate and soil requirements, irrigation methods, environmental disorders, effects of climate change
	Vegetable production	Controlled environmental production and facilities
	Citrus production	Soil and climatic requirement
	Landscape and ornamental horticulture	Controlled environmental production and practices, irrigation systems and planting
	Agro-processing (crops)	Waste management in food security

Agribusiness	Agricultural extension Applied farm account Introduction to management and agribusiness Agricultural marketing Supply chain management Human resource and farm business management Entrepreneurship Production economics Agricultural food systems Financial management project management	Ecological and environmental factors associated with food systems
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Source: Author

The analysis in Table 5.2 highlights an inconsistent integration of climate-related themes across the specialisations of the Diploma in Agriculture programme. In the Agribusiness specialisation, out of 10 course units, only one addressed climate change. Crop production, on the other hand, impressively integrated climate themes into all its six course units. Animal production showed some attention to the matter, with five out of its nine course units touching upon climate change or sustainability. Nevertheless, the depth of content related to climate change remained superficial in most units, especially outside the crop production specialisation, indicating a need for a more comprehensive inclusion of these themes.

5.5.2 Curriculum Resilience Assessment Tool review results

This sub-section presents results from the curriculum review using the Climate Resilience Assessment Tool (refer to Appendix 1).

Each of the three specialisations for the Diploma in Agriculture was assessed separately as described in Chapter 4, section 4.5.3, and the results on how each is responsive to climate resilience were determined and are presented below.

Following the methodology described in Chapter 4, section 4.5.3, Figure 5.1 depicts a graphical representation in percentages derived from the assessment criteria in the previous sections to determine the extent of climate resilience integration. This includes various indicators of the curriculum crop production, a specialisation under the Diploma in Agriculture and how each fared against the climate resilience in the Climate Resilience Assessment Tool. The figure illustrates the data, allowing for clear comparisons into areas of strength and potential improvement in the curriculum.

Specialisation 1: Crop Production

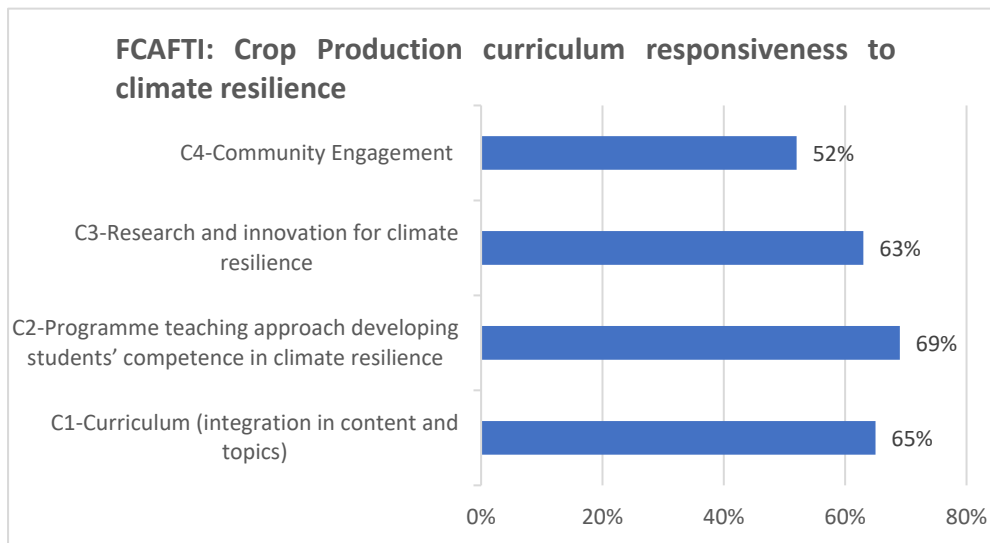


Figure 5.1: Climate Resilience Assessment Tool score analysis for crop production specialisation

Figure 5.1 above shows the different sections of the crop production specialisation. In summary, the curriculum for crop production specialisation of Diploma in Agriculture at FCAFTI displays a varied degree of integration of climate resilience across different sections:

Teaching Approach (Section C2): The curriculum appears to be most responsive in its teaching methodology, with a score of 69% responsiveness. Research participants indicated that the curriculum developed students' understanding of climate resilience as indicated by Indicator B4's high average score of 3.8 (see Appendix B1). Indicator B4 probed participants to know whether the curriculum teaching approach creates a sense of responsibility towards the community, ecological system and the environment. According to the criteria, this score may indicate adequate responsiveness to climate resilience, implying that the teaching approach develops students' competencies in climate resilience.

Study Content and Topics (Section C1): The curriculum demonstrated a significant focus on climate resilience, scoring 65% responsiveness. As indicated by Indicator A2, which probed the level of integration of water management topic into the study curriculum (see Appendix 1), water management practices were highlighted as a strong point in the curriculum with an average score of 4 or 80% (see Appendix B1).

Research and Innovation (Section C3): With a responsiveness score of 63%, the score shows that the curriculum provides adequate opportunities to students to engage in climate resilience

research. However, more effort is required in securing financial support for students and staff to conduct research and develop agricultural innovations for local climate change interventions as Indicator D6's average score of 2.2 or 44% (see Appendix B1) indicates. This indicator probed whether the institution provides adequate financial support in form of bursaries and other grants to staff and students to engage in researching and developing farming innovations that address climate change.

Community Engagement (Section C4): Scoring responsiveness of 52%, the findings suggest there is room to improve the department's community engagement initiatives on climate resilience. While some projects involving students and lecturers highly consider climate resilience as shown by Indicator E5 which explored whether aspects of climate adaptation and mitigation are key in the criteria for selecting which projects to execute in the local community, the results further showed that there is still a need to improve community engagement outcomes concerning climate resilience in other areas such as resource allocation (Indicator E2) and the department's engagement in projects addressing issues of climate adaptation and mitigation (E1). Both Indicator E1 and E2 scored an average score of 2 or 40% (see Appendix B1), which according to the criteria in Table 4.5 (refer to Chapter 4, section 4.5.3) indicates performance but requires improvement.

These findings suggest that while FCAFTI's curriculum for crop production specialisation has made strides in embedding climate resilience, there remain areas that could benefit from more focus and investment, especially in community engagement and student participation in research.

Specialisation 2: Animal production

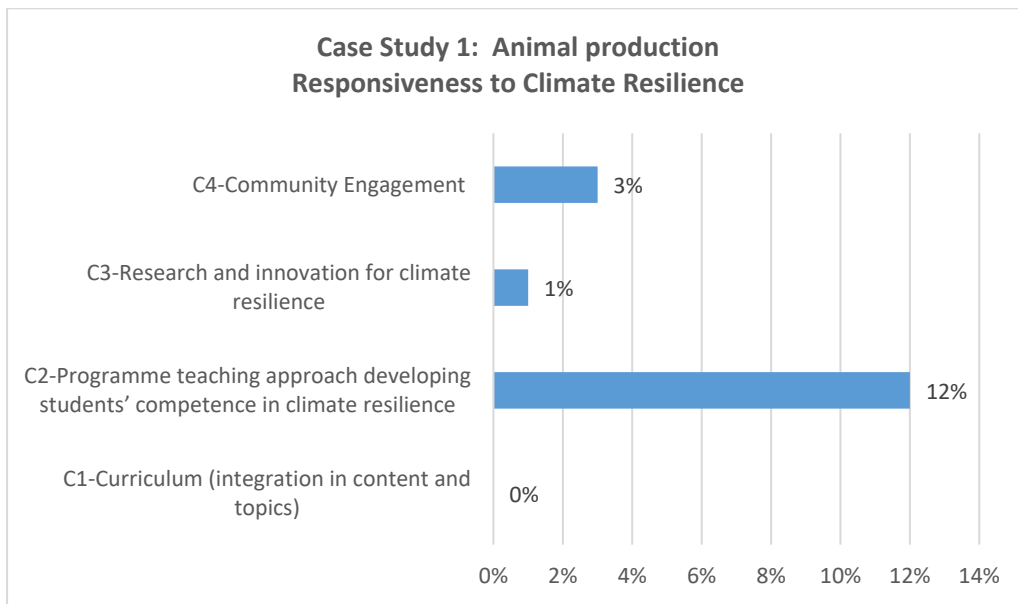


Figure 5.2: Climate Resilience Assessment Tool score analysis for the animal production specialisation.

The review of the Animal Production specialisation for FCAFTI's Diploma in Agriculture curriculum regarding climate resilience in Figure 5.2 above reveals low levels of responsiveness across all sections:

Teaching Approach (Section C2): With the highest responsiveness score across all sections, this section still only managed 12%. This indicates a significant shortfall in integrating climate resilience principles in teaching methodologies.

Community Engagement (Section C4): With a mere 3% responsiveness, it is evident that student and departmental engagements with the community on climate resilience are extremely limited.

Research and Innovation (Section C3): At a meagre 1%, this score suggests an almost negligible emphasis on climate resilience within the research and innovation aspects of the curriculum.

Study Content and Topics (Section C1): This section's score of 0% underscores a complete lack of inclusion of climate resilience topics and content.

These findings indicate a severe deficit in addressing climate resilience within the curriculum, highlighting an urgent need for comprehensive curriculum revision and transformation to adequately address contemporary climate challenges.

Specialisation 3: Agribusiness

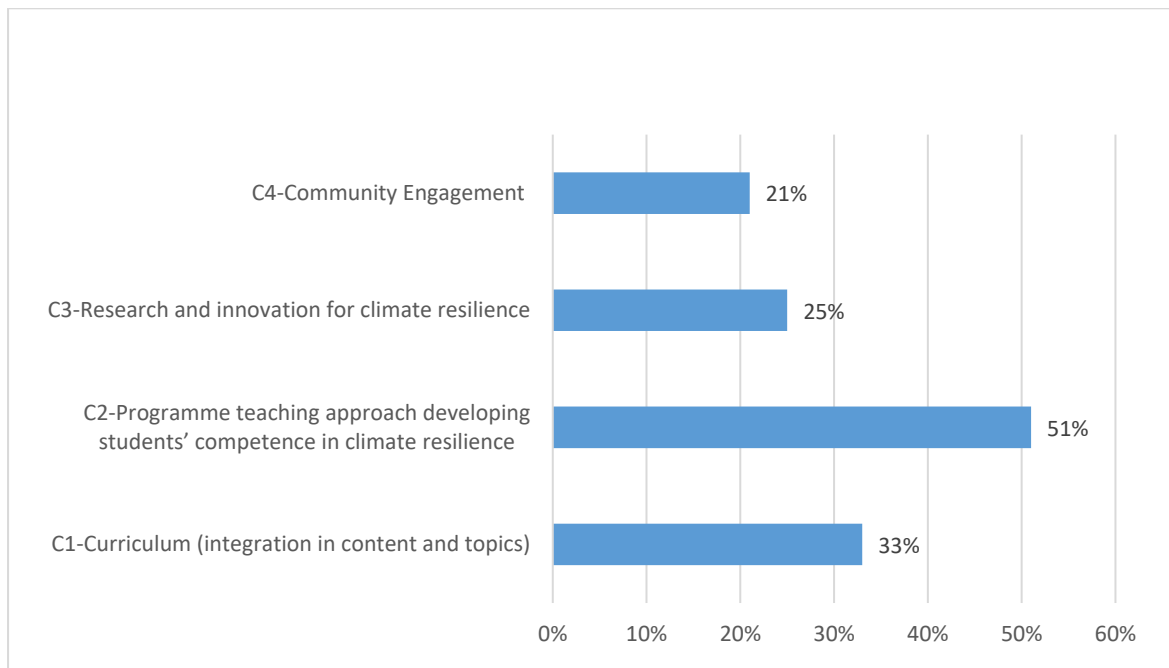


Figure 5.3: Climate Resilience Assessment Tool score analysis for the agribusiness specialisation

The Agribusiness specialisation mirrors the challenges observed in the animal production specialisation regarding curriculum responsiveness to climate resilience:

Teaching Approach (Section C2): Scoring a responsiveness of 51%, the teaching approach exhibits some degree of attention to climate resilience, but there is room for improvement. The curriculum appears to instil a moderate sense of responsibility in extension students towards community and environmental sustainability, with Indicator B4 attaining an average rating of 3.4 or 68% as shown in Appendix B3. Indicator B4 probed participants to know whether the curriculum teaching approach creates a sense of responsibility towards the community, ecological system and the environment.

Study Content and Topics (Section C1): Achieving a 33% responsiveness, this section shows considerable gaps in the integration of climate resilience in study content.

Research and Innovation (Section C3): The score of 25% in responsiveness signifies a modest focus on climate resilience in research and innovation, highlighting the need for broader inclusion.

Community Engagement (Section C4): The 21% responsiveness points towards limited engagement in community-based initiatives that focus on climate resilience.

To contextualise the findings: Among all specialisations, Crop Production displayed the most satisfactory responsiveness to climate resilience. A comparison of Section 1's results across all specialisations with the curriculum content analysis from section 5.5.1 reaffirms the robust integration of climate change within the Crop Production specialisation. In contrast, both Agribusiness and Animal Production portray weaker integration, reinforcing the call for more holistic curriculum reforms across the board.

As mentioned in section 5.5, a Curriculum Resilience Assessment Tool was used to review climate resilience within the curriculum. Subsequently, FCAFTI lecturers and former students, now extension officers, were interviewed. Both groups shared insights on the curriculum's theoretical responsiveness and practical applicability concerning climate resilience.

5.5.3 Curriculum responsiveness as represented in interviews

In this section, I present findings from interviews concerning the curriculum's responsiveness to climate resilience. I interviewed lecturers from FCAFTI and extension officers familiar with the Diploma in Agriculture offered at the same institution. The feedback converged around three primary themes: curriculum content, its implementation, and the periodic review and updating of the curriculum.

5.5.3.1 Curriculum content

Regarding the curriculum content, interviewed extension lecturers highlighted a growing need for better integration of climate change topics and described the curriculum as inadequate. Besides the crop production specialisation, the lecturers' observations resonated with the findings in sections 5.5.1 and 5.5.2. These sections indicate that the Diploma in Agriculture at FCAFTI has inadequately incorporated climate change-related content. The following excerpts from interviews with lecturers summarise these sentiments on the curriculum content:

Well, I think climate change is mentioned in the curriculum, but I don't think there's a lot of emphasis, and I don't think it's getting the amount of attention it deserves. Yeah, for one reason or another. But the curriculum doesn't make noise about climate change.
(SA-L1)

The curriculum is not adequate enough to really prepare competent agricultural extension officers that could be able to handle the highly sophisticated economy of South Africa. We have both commercial farmers or some call them White commercial

farmers, and also the Black farmers. We are finding that most of these Black farmers, they were seriously disadvantaged in so many areas and still need a lot of support. Now, if you look at the emerging issues in relation to agriculture development, right now, you find it that the curriculum is still lacking and does not talk to the industry or address the farmers' needs. (SA-L3)

Lecturers emphasised a significant shortfall in the curriculum: the insufficient inclusion of climate change into study content. This omission, they suggested, could compromise the quality and relevance of graduates within the occupation and broader industry. A distressing remark from lecturer SA-L3 summed up the sentiment: “the curriculum is talking to the early 80s or 90s type of farming. We are not going to produce very good extension officers that will be able to address some of these emerging issues like climate change if we don’t overhaul the curriculum”. They voiced concerns that extension officers, with this limited education, might struggle to support rural farming communities, especially in the Eastern Cape and other parts of South Africa grappling with climate-induced challenges like water scarcity. Moreover, lecturers critiqued the curriculum’s heavy theoretical orientation. They noted a significant imbalance between classroom learning and practical experience, stressing that students receive limited exposure to hands-on projects that would enhance their understanding and skills in climate resilience. The lecturers’ statements further reflect this concern:

The curriculum is mostly bloated, in terms of theory, to the extent that students don’t have time to be practically exposed to gain skills like climate. You find students doing 30-35 courses within a diploma programme. You’re looking at about seven or eight courses per semester. And, yeah, it’s quite a packed curriculum in terms of the theoretical activities that they need to be covering. So that alone is a problem. (SA-L1)

On the need to improve the curriculum with practical orientation, Lecturer SA-L3 stated that.

Now, there are modern technologies, if you have some competent employees from the industry to improve the curriculum to accommodate some of these emerging issues, you’ll find that the graduates we are producing are going to be employable within the within the new system.

5.5.3.2 Curriculum implementation

Apart from the curriculum’s content, the implementation process itself has been identified as a major impediment to effectively infusing climate resilience into students’ skill sets. Interviews

exposed institutional challenges both internal and external to FCAFTI that hinder the curriculum's thorough execution. A major concern was the bureaucracy from the institution's internal management, which limits students' opportunities to engage in practical experiences, field trips, and demonstrations related to climate resilience. Such administrative challenges are not only limiting the curriculum's potential but also demotivating, as captured by a remark from lecturer SA-L2, who said, "You find within an institution there are people who are just sitting to make sure that things don't happen". Additionally, financial constraints play a role in limiting the integration of climate-centric aspects into the curriculum. Although FCAFTI receives a significant portion of its budget from the Department of Agriculture (80% as outlined in the 2021-2025 strategic plan), it remains dependent on external funding for various activities. This was further elaborated upon by another lecturer who stated:

The implementation of the curriculum is a bit difficult. So, while there are set practicals that would have been enshrined within the curriculum and set out in the course outlines, etc., you find that it is practically difficult to implement all of them, maybe we can do a few of them, and a few excursions here and there to take the students to a certain farm once a semester, and they are done with the course. It can be because of resources; this could be human resources or financial resources, the means of transport to get to where you want to go, or even the tools to do what you want to do within the College.
(SA-L2)

The observation underscores the financial challenges the College may be facing, suggesting that despite receiving substantial funding from the Department of Agriculture, there might not be enough flexible funds available. This financial limitation potentially hinders the institution's ability to immerse students in sustainability-focused activities, thereby impacting their learning experiences on climate change.

5.5.3.3 Reviewing and updating the curriculum

The curriculum review at FCAFTI aims to incorporate climate-related content, but lecturers perceive the process as tedious and filled with bureaucratic challenges. Previous stakeholder meetings to review the curriculum have touched upon sustainability features such as rainwater harvesting. However, integrating more specific climate change content faces challenges. The stringent requirements set by the Department of Higher Education and Training, coupled with a prolonged approval procedure from the Council for Higher Education, contribute to the delay

in updating the curriculum to address contemporary environmental challenges as one lecturer remarked:

Changing the curriculum has been a little bit difficult ... it is also a very lengthy and rigorous process to really change a curriculum because it has to pass through different stages before getting to the Department of Higher Education and Training to approve it and it also has to pass through some professional bodies. (SA-L3)

Lecturers at FCAFTI reported that past curriculum review workshops drew a diverse group of stakeholders, such as local farmers, universities in the Eastern Cape, development agencies, municipality representatives, industry experts, and extension officers, to provide their insights.

All interviewed lecturers at the College voiced the need for consistent curriculum reviews to include updated topics on climate change in agriculture, thereby enriching students' knowledge of climate change and stimulating their climate resilience skills. SA-L1 highlighted the urgency of this need, commenting on the curriculum's inadequacy and emphasising the importance of its regular updating, possibly every 5-10 years, to reflect the evolving environmental challenges. SA-L1 remarked, "I must confess that the curriculum is highly defective, that we need to be changing our curriculum almost every now and then, maybe every five to 10 years, to really accommodate all the changing issues in our environment".

The curriculum's present content, according to lecturers, is not aligned with the demands of emerging Black farmers in the Alice region. These farmers often bypass extension officers, whom they deem ill-equipped to advise on emerging critical issues, and instead, seek guidance from established commercial farmers. Lecturer SA-L3 observed that the curriculum reflects farming practices from decades ago, making it obsolete for today's challenges. He further highlighted the risk of extension officers becoming irrelevant if the curriculum does not evolve. SA-L3 stated that; "the curriculum is talking to the early 80s or 90s type of farming", and added that because the curriculum does not equip extension officers to address issues of emerging Black farmers,

... most are teaming up with the Ward[an administrative zone] commercial farmers to capacitate them. Commercial farmers are now serving as their mentors and both are unified that the extension officer is going to be irrelevant to them after some time because they don't need it, because they are now getting the real practicality from being a mentee on a successful commercial farmer.

Echoing these sentiments, extension officers familiar with the FCAFTI Diploma in Agriculture programme admitted the curriculum lacked a focus on contemporary climate change topics. Most of their expertise in areas such as rainwater harvesting and climate-smart agriculture stemmed from external programmes like Amanzi for Food and affiliated platforms like the Imvothu Bubomi Learning Network. Collectively, the extension officers felt that the curriculum for the Diploma in Agriculture at FCAFTI requires an overhaul to address the dynamic challenges of agriculture in both the Alice region and South Africa as a whole. SA-L3 stated had that “actually, it [curriculum] has not been updated, and that’s why I say that we have been having series of a workshop on our recovery of curriculum”.

Extension officers made remarks on the review of the curriculum and the need to update the curriculum:

I can highlight the issue that the extension curriculum at Fort Cox and other institutions of higher learning needs to be reviewed maybe once in five years to check if it is still relevant. You see, those manuals or those courses can be upgraded and taken to the relevant SAQAs so that they can cater for the extension of today. So that a graduate from a university or College can be able to respond to the current needs and challenges faced by our farmers today. (SA-EO3)

Another extension officer submitted that reviewing and updating curriculum should be a collaborative effort from all concerned stakeholders:

...maybe they should create some platforms where maybe the Department [Department of Agriculture], the extension officers, people from the universities, and the Department of Higher Education would meet to see and look it maybe twice a year and have those sessions one week session in one place and discuss those issues, and include industry players , producers of production inputs, fertiliser companies, so that our curriculum can talk to what is needed by the farmers and market. (SA-EO2)

The findings in sections 5.5 to 5.5.3 underscore the significance of VET preparation for extension officers, with the curriculum being central to their training. Multiple sources—including a curriculum document review, the Climate Resilience Assessment Tool analysis, and feedback from both lecturers and extension officers converges on the finding that FCAFTI’s Diploma in Agriculture curriculum requires a stronger focus on climate-related topics. The study also underscores the urgency for curriculum content to be regularly updated on climate

change themes. Additionally, there is a clear call for a shift from theory to more hands-on, practical activities, allowing students to acquire practical skills in climate resilience. Both extension officers and educators concur that as climate change becomes an increasingly salient issue in agriculture, extension officers must be equipped to support small-scale farmers against this backdrop.

5.5.4 Experiences and work-related activities of extension officers

As outlined in Chapter 1, section 1.3, another component of the third objective of this study was to review the lived experiences and associated work activities of those involved in extension services. Drawing from the data gathered during interviews with farmers, extension officers, and lecturers from FCAFTI, this section sheds light on the depth of extension officers' competencies concerning climate resilience and their knowledge of climate change. Participants were probed about their personal experiences with and knowledge of climate change. Furthermore, they were asked about the support they provided to the farming community in Alice to help them navigate the complex challenges posed by climate change.

Extension officers exhibited an understanding of their traditional roles in assisting farmers, especially in conveying relevant agricultural information and providing farm inputs. However, they highlighted the evolving challenges brought about by climate change. In their work activities, they expressed difficulties in accessing and disseminating climate-specific information to farmers. Currently, they stated that there is an absence of a unified national or local hub where they can gather accurate climate information to guide farmers. SA-EO1 stated that:

Even the Department does not have a place to get this information [climate information]. Maybe they don't have the capacity, or they don't think it is a major issue. But truth be told we don't have a go-to place like a website or something to get information to share with farmers in rural villages.

The officers emphasised the farmer's climate-related challenges, such as changing planting seasons, which are heightened by this information gap. This void in crucial climate information hampers their role as information intermediaries and exacerbates farmers' expectations of receiving timely and relevant information.

Furthermore, extension officers admitted their shortfall in specialised knowledge of climate resilience. As SA-EO3 remarked, there is a pressing need for enhanced training and capacity-building: “I think we have an issue of training. We need more training, more capacity, more awareness to the extension personnel so that they are able to live with these times and relay relevant information with regard to climate change”.

Farmers in interviews corroborated the absence of climate information. They lamented over the changing planting seasons, emphasising their frustrations. This issue is exacerbated by the minimal support they receive from extension officers concerning climate-related information. One farmer remarked on the changing seasons, noting:

We used to plough maize in August or September, but because of climate change, we are unable to do that. We plough maybe in October, actually in November, at that time sometimes it is cold, and then you cannot plough the maize in cold weather. (SA-F2)

Extension officers admitted to lacking expertise and knowledge on climate-related subjects. To address this, they occasionally set up informational sessions on pertinent topics for farmers, bringing in experts from various organisations providing private extension services or the Department of Agriculture. SA-EO2, an extension officer, mentioned, “We organise information days on a particular topic that has been identified. We are at liberty to co-opt other specialists in the Department or outside, even in the private sector, even in NGOs, to come to form part of our information days.”

In Alice, a widely expected function for extension officers is technology transfer. Through interviews, extension officers shared that their duties involve facilitating the introduction and sometimes testing of new agricultural technologies with farmers. SA-L1 emphasised, “An extension officer should be somebody who bridges that technological gap between farmers who are probably sitting with old technologies and the new technologies that happen to be out there”. Notably, extension officers highlighted the issues farmers face with water scarcity and droughts. Thus, as intermediaries in technology transfer, they believe their focus should be on promoting climate-smart technologies. SA-EO3, an extension officer, commented, “...in terms of climate change, we are supposed to support these farmers with technologies so that they can use them to overcome some of the challenges of climate”.

Most lecturers I interviewed echoed the extension officers’ sentiments regarding the

importance of supporting farmers in adopting climate-friendly technologies. Yet, they emphasised the need for extension officers to familiarise themselves with new and modern technologies. SA-L3, a lecturer, highlighted, "... when you look at the coming of drones, apps, there are a lot of things that are changing the landscape of agricultural extension. We need to get acquainted with some of all these technologies that are coming up for us to be highly relevant within the profession". SA-L3 emphasised the importance of equipping extension officers with knowledge on climate-smart technologies. He argued that extension officers would be ill-prepared to support farmers in adapting and mitigating climate effects without proper training and access to these technologies. SA-L3 stated, "If you don't provide the necessary training and technologies to extension officers, they cannot effectively address these challenges."

Furthermore, in the interviews, extension officers expressed that while they are tasked with facilitating technology transfer to farmers, they themselves face knowledge and skills deficits related to innovative climate solutions in agriculture. Collaborative efforts with research institutions and NGOs are meant to bridge this gap, but the challenge persists. Notably, in regions around Alice, it is the medium to large-scale farmers, such as citrus fruit producers, who have the financial means to implement climate-smart technologies. Smallholder farmers, who form the majority of the clientele for these extension officers, rarely use these technologies. Consequently, the officers have limited exposure to and experience with these advanced solutions.

The extension officers' role is essential in the agricultural sector as primary agents of knowledge transfer. This sentiment was echoed by SA-L2, who emphasised that these officers are often the primary interface between farmers and the agricultural knowledge base, and they address a broad spectrum of challenges, "they are that first point of contact with the farmer when it comes to knowledge sharing and being able to address a diverse set of problems". Officer SA-EO3 corroborated, underscoring the critical role of extension officers in ensuring food security by transmitting knowledge tailored explicitly to agricultural production. He stated that extension officers "transfer knowledge to the farmer... specific to agricultural production so they produce their own food to ensure there is food security". The climate-induced challenges, especially water scarcity in Alice, have made the role of extension officers even more significant. Interviews indicate an intense expectation among farmers that these officers will equip them with knowledge of sustainable farming practices. They expect this climate-

related knowledge to empower them to combat the devastation that water shortage inflicts on both crops and livestock. There is a consensus among the farming community that if extension officers could consistently offer guidance on climate-adaptive agricultural practices, it would go a long way in enhancing their resilience to the effects of climate change, allowing for year-round food production.

Some farmers remarked concerning their expectations of extension officers:

They [extension officers] are supposed to be giving us technical support, like advising the farmers, especially with climate change, when and what crops should be planted, and they should be advising farmers on things like rainwater harvesting to save water so that then farmers can be able to produce even during drought. (SA-F1).

One time I tried to contact our agriculture officer, because I am also farming with pigs and goats, and that time I was having a big problem with water. Because they are dying, but I didn't get any support. I am struggling to get water and my plants are dying even now. Maybe agricultural officer should organise boreholes for us. We are having a big problem because of climate change. (SA-F3)

I am an organic farmer, and most extension officers don't know, because they are not trained in organic farming. They are trained in the conventional way of farming at the tertiary institutions. So, now, if you come in to consult them about farming and that they don't know, they will want to give you like fertilisers weed control. If you refuse, then they won't be able to assist you... I think they should listen to us and support us in our ways of farming. And I think that that extension officer should know the groups or individual farmers that is serving in his ward and assist those people according to their needs. (SA-F2)

Some farmers and extension officers revealed in interviews that their learning on climate-related farming practices, such as agroecological farming and rainwater harvesting, is facilitated by experts in a social learning platform, Imvothu Bubomi, with one farmer asserting that:

And for me, again, with my group in the Learning Network, whenever we have problems, we just post the probing questions there, and whoever is there knows the answer, then they can answer, and fortunately for us, we even have academics there, we have got farmers, we have got extension officers. So we will find a solution to

whatever problems you have. And it's diverse because some are from different universities, Fort Hare and other agricultural colleges, so it's rare that you don't find any answer to what you want to know. (SA-F1)

So, and again, we've got other partners like Imvothu Bubomi organized by the experts from Rhodes University and there are others from Fort Cox from that network it I mean, various people from townships and rural areas form that network. So, we discuss our issues, even the challenges and we do have our WhatsApp group... (SA-F2)

Referring to the usefulness of the social learning network, farmer SA-F2 further expounded that:

Whenever we have a problem, like we would say please come and assist me with the drip irrigation, because of the challenge of lack of water. What we would do is to just organise ourselves and tell them which skills gaps needs to be closed and what exactly we want to be trained in, and the challenges we are having, and they would come for meetings.

In Alice, extension officers recognise the significant threat of climate change to smallholder farming. Their primary responsibilities are to transfer crucial climate information to farmers, promote climate-smart technologies, especially in the face of water scarcity and drought, and educate farmers on sustainable farming practices. However, they encounter challenges due to the absence of a centralised climate information source and the inaccessibility of advanced climate technologies for smallholder farmers. While the Imvothu Bubomi learning network has bridged some of these gaps, providing a platform for discussing sustainability and sharing best practices, there is a clear need for more in-depth training and resources for extension officers to better support their communities.

5.6 Labour market and policy analysis

In response to study objective 4 (reviewing agricultural extension and VET policy and labour market data for its responsiveness to climate resilience – as stated in Chapter 1, section 1.3), this section focuses on examining labour market information sourced from secondary documents. The focal point of this assessment is the extension officer occupation, highlighting key aspects specifically entry requirements, main qualifications, requisite skills, experience, and core knowledge. Additionally, their primary tasks and roles are appraised. The review of

the labour market further extends to the assessment of occupational classification frameworks, to discover their responsiveness to climate resilience needs. The second part presents the policy analysis for VET and Extension concerning their responsiveness to climate change.

5.6.1 Labour market analysis

In the first segment of labour market analysis, I examined labour market information by scrutinising job listings. Eleven listings recruiting extension officers accessible online and published from 2019 through 2022 were initially gathered. Most adverts related to extension officer occupation were catalogued in the 2022 Department of Public Service and Administration vacancy circular, as detailed in section 4.6, Table 4.5. Of these, only three job adverts were deemed sufficiently representative and thus have been showcased below in Table 5.3. My analytical emphasis was trained on identifying task/role descriptions, core knowledge areas, minimum academic qualifications for entry, and categorising required skills and competencies. This aimed to provide a succinct overview of the fundamental labour market occupational requirements for extension officer occupation and to highlight its responsiveness to climate resilience.

Table 5.3. Extension officer occupation requirements based on market information

Job advert 1 Chief Director: Agricultural Services	Job advert 2 Agricultural Advisor – Extension Services	Job advert 3 Agricultural Advisor	Core requirements
Minimum qualifications recognised in the National Qualifications Framework ((NQF)			
A Bachelor of Science degree in agriculture/ bachelor’s in agriculture plus an Honours degree in Agriculture (NQF level 8)	Matric certificate plus a relevant NQF 7/ four-year qualification in agriculture	An appropriate four-year qualification in agriculture or equivalent qualification within the agricultural field as recognised by SAQA	Diploma in Agriculture at NQF level 7 recognised by South Africa Qualifications Authority (SAQA)
Duties/Tasks			
Coordinate the comprehensive agricultural extension and advisory implementation services over the district municipal areas in the province. Provide strategic direction for agricultural extension and advisory services. management of	To promote sustainable development in the agricultural sector through the application of the appropriate extension principles and methods. Provide technical support for organised agriculture and other agricultural stakeholders and assist	Deliver continuous support to all farmers, especially developing farmers across all functions, which include land reform, infrastructure development, extension and support on production and	Application of extension principles to deliver continuous support to farmers, getting involved in land reform, extension support on production and economic

agricultural extension and advisory support services. Optimise management of project office. Manage the resources of the Chief Directorate.	with planning, advice and aftercare. Promote sustainable production of agricultural products. Determine the research needs of the area. Establish and enhance the relationship with clients and stakeholders. Provide continuous support to ensure sustained production and improvement.	economic principles, institutional support as well as capacity building of food security. Assist with research and demonstration trials under supervision. Provide information on markets. Facilitate workshops and planning sessions to determine the needs and progress.	principles, assisting with research and demonstration trials, providing information on markets, institutional support and capacity building in food security
Knowledge			
Understanding of South Africa's Constitution, and the following Acts ⁷ : PSA, PSR, PFMA, LRA, EPMDS, BCEA, Community Development, Public Participation, Scientific Agricultural Production methods, Agricultural Extension and Advisory Principles, Project Management Principles, Social Dynamics	Extensive knowledge in agricultural advisory, knowledge of project planning and management. Knowledge of public service legislation, Integrated Development Plans, Provincial Growth and Development Strategies (PGDS) and Curriculum Assessment Policy Statements (CAPS)	Production of crops and/or livestock produced in the specific area, also markets and value adding; practical research; good understanding of land reform programme and project implementation	Understanding of Extension in crop/Animal production, Knowledge of key policies in agriculture and extension, a good understanding of the land reform programme and project implementation, knowledge of the context
Skills and Competencies			
Listening, presentation, analytical thinking, interpersonal relations, computer skills, strategic planning skills, organisational, research, analytical, leadership, project management, facilitation, financial management, time management, report writing, problem-solving, communication, conflict management, change management, decision making and people management	Report writing skills, computer skills, problem-solving skills, analytical skills and ability to communicate with stakeholders at all levels	Good communication (written and verbal) and presentation skills; proven computer literacy in Microsoft office (Excel, Word, PowerPoint); problem-solving ability; research skills; time management; ability to work under pressure	Communication, presentation, computer skills, problem-solving, analytical thinking, report writing, research, conflict management, stakeholder management <i>Source: Author</i>

⁷ Public Service Act (PSA), Public Service Regulations (PSR), Public Finance Management Act (PFMA), Employee Performance Management and Development System (EPMDS), Basic Conditions of Employment Act (BCEA), and Labour Relations Act (LRA).

From the data presented in Table 5.3, there are four main takeaways. Firstly, there is a clear prioritisation of academic qualifications over other criteria in the labour market for the extension officer occupation. All the job adverts prominently positioned academic qualifications at the forefront of their requirements, suggesting a significant bias during the hiring process. A requirement for entering the position of an extension officer is an academic qualification in agriculture benchmarked at NQF level 7⁸. This requirement was met by every extension officer I interviewed, as can be observed in Chapter 4, section 4.2, Table 4.2.

Secondly, closely following academic qualifications in job adverts are the task or role descriptions expected of extension officers. These descriptions indicate various work tasks within the scope of extension services, which are elaborated further in Chapter 1, section 1.6 as ‘workstreams’. An analysis of the data reveals that these task descriptions lean heavily towards the conventional roles of extension officers, namely, information dissemination, technological and knowledge transfer. Surprisingly, there is a glaring under-representation of duties related to climate change or sustainable agricultural practices, with only one advertisement underscoring the importance of “promoting sustainable development in the agricultural sector”. The main scopes of work (in this thesis referred to as workstreams) discerned from the task descriptions encompassed areas such as agricultural research, marketing, production, value addition, policy, and agribusiness management. The skills and knowledge associated with these workstreams might stem from occupations related to the extension officer, like those listed in Table 5.4, for example, the agricultural scientist and agricultural farm manager. However, they (workstreams) might also be derived from roles that are seemingly unrelated, such as the conservation scientist, policy analyst, and business development officer, as discerned from Organising Framework for Occupations (OFO) based on their role descriptors.

The third noticeable observation from the analysis was the pronounced emphasis on the necessity of understanding policies and legislation as part of the core knowledge for extension officers, often overshadowing the technical knowledge vital for executing their primary tasks. ‘Core knowledge’ refers to the fundamental expertise that is imperative for competently executing the main responsibilities of a given occupation. Remarkably, the analysis did not

⁸ South Africa’s NQF has 10 levels stratified into three categories: NQF Levels 1 to 4 equate to high school grades 9 to 12 or vocational training, NQF Levels 5 to 7 are college diplomas and technical qualifications, and NQF Levels 7 to 10 include advanced diploma and university degrees. See more details at <https://fundiconnect.co.za/nqf-levels-whats-that-stuff-about/>.

pinpoint any specialised knowledge prerequisites for those in the extension service occupation. This observation resonates with the sentiment expressed by extension officer SA-EO3, who noted:

Because we're general practitioners, we end up not mastering anything relying on sourcing specialists from outside most of the time. And with that, sometimes some clients lose some confidence in us and might have to give credit to those who are specialising in the field as people who help them other than extension personnel who normally visit them on a daily basis.

The remark by extension officer SA-EO3, in conjunction with the analysis, affirms the notion that extension officers in Alice possess surface knowledge and appear to lack a profound grasp of core knowledge, particularly concerning climate change that is already impacting the farmers they serve.

Lastly, in the hierarchy of requirements for extension officers, skills and competencies were ranked at the bottom. Notably, these skills and competencies leaned towards general administrative and managerial capacities, with an evident absence of competencies tailored specifically for agricultural extension services domain and climate resilience specifically.

5.6.2 Analysis of the occupational classification frameworks

The second segment of the labour market analysis involved analysing the occupational classification framework applied in South Africa. I analysed the Organising Framework for Occupations (OFO) to understand how occupations were structured and described and compared the two versions of OFO (2013 and 2021) to identify occupations related to the extension officer occupation, mainly regarding the task descriptions and whether climate change was a prominent aspect. I also analysed information to understand where career progression for extension officers is possible and the differences and possible rationale for developing such occupations. In addition, the careers advice portal for the Department of Higher Education and Training (DHET) was accessed to identify recognised qualifications and their level associated with occupations in the National Qualifications Framework (NQF).

I undertook an analysis of the 2013 and 2021 Organising Framework for Occupations (OFO), intending to identify occupations that share similarities with the extension officer occupation,

mostly with task descriptions. This aimed to spotlight potential pathways for career progression and identify variations between extension officer occupation and possible justifications for formulating such occupations. I accessed the careers advice portal for the DHET in a bid to uncover recognised qualifications and their respective NQF levels as mapped out in the NQF. Table 5.4 shows the extension officer occupation and related occupations in South Africa's Organising Framework for Occupations developed by DHET.

Table 5.4. Extension and related occupations and role descriptions from the OFO

OFO Code	Occupation	Occupation description (OFO)	Broad Tasks for all farming advisor occupations (OFO category 2021-2132)	NQF Level 7
2021-213201	Agriculture Extension Officer	Advises farmers, agricultural businesses, rural industries and government on the production, processing and distribution of farm products.	<ul style="list-style-type: none"> • Developing procedures and techniques for solving agricultural problems and improving the efficiency of production • Studying the environmental factors affecting commercial crop production, pasture growth and animal breeding • Advising on techniques for improving the production of crops and livestock. • Advising on livestock and crop disease, control of pests and weeds, soil improvement, animal husbandry and feeding programmes • Preparing scientific reports and conducting advisory information sessions and lectures for farming communities and other groups • Studying the effects of cultivation techniques, soils, insects, and diseases on animal yield • Researching into characteristics, use capability and productivity of soils and applying findings to develop improved agricultural and horticultural practices. • Collecting and analysing data and samples related to produce, feed, soil, water quality and other factors affecting farm production. • Investigating, planning and implementing management procedures to cope with the effects of fires, floods, droughts, soil erosion, pests and diseases. 	Level 7
Occupations related to extension officer occupation				
2021-314201	Agricultural Technician	Performs tests and experiments and provides technical support to assist agricultural scientists and technologists in areas such as research, production, servicing and marketing.		Level 7
2021-131101	Agricultural Farm Manager	Plans, directs, and coordinates production in large-scale agricultural and horticultural operations such as collective farms and agricultural cooperatives to grow and harvest crops.		Level 7
2021-213202	Agricultural Scientist	Studies commercial plants, animals and cultivation techniques to enhance the productivity of farms and agricultural industries.		Level 7

Source: Author

The data from Table 5.4 provides descriptions of the broader roles of extension officers; there are similarities with those designated to other occupations within the agricultural sector,

especially when compared to the roles outlined in Table 5.3 for agricultural scientists and farm managers. This similarity implies that there is a viable possibility for horizontal labour mobility across these occupations. “Horizontal progression”, in the context of occupations, is demonstrated by the lateral movement of individuals from one position to a comparable one in a different occupation without necessarily advancing in hierarchy or responsibility.

The broader task category for agricultural advisors, as outlined in the Organising Framework for Occupations (OFO), subtly acknowledges the impact of climate effects, but it does not explicitly focus on climate change resilience measures, nor does it specifically assign these responsibilities to the Agricultural Extension Officer occupation. According to Table 5.4, the OFO indicates that agricultural advisors bear the responsibility for investigating, planning, and implementing management procedures to address floods, droughts, pests and diseases, and soil erosion. While this designation covers a range of climate-related challenges, the language used in the OFO lacks a direct emphasis on climate resilience which is increasingly crucial in the context of climate change and its impact on agriculture.

When examining the 2013 and 2021 editions of the Organising Framework for Occupations (OFO) with a focus on agriculture-related roles, there was a notable difference in occupational classifications. Specifically, the 2021 OFO introduced four new occupations not listed in 2013 one: vegetable consultant, land care officer, pasture consultant, and orchard consultant. Additionally, other occupations, such as agronomist, community liaison officer, community development practitioner, and community development officer, had job descriptions similar to those of extension officer occupation. Even more, role descriptions for occupations such as the conservation officer and climate change scientist appear to have scopes that could be seamlessly integrated into the responsibilities of an Agriculture Extension Officer.

A significant observation drawn from comparing both OFO editions (2013 and 2021) is the evident fragmentation and specialisation in agricultural occupations. As DHET continues to introduce new occupations into the agriculture field of practice, the extension officer occupation’s scope seems to reduce further, yet practically in the field, the public expectations of extension officers and the way their role is conceptualised remains very broad. This may suggest that artificial creation of new occupations by the DHET does not have a tangible effect on these occupations are operationalised except for reducing the role of extension on paper and not in practice.

The comparison of the Organising Framework for Occupations (OFO) editions from 2013 to 2021 reveals a noteworthy trend in the agricultural sector, particularly concerning the occupation of extension officers. The Department of Higher Education and Training (DHET) in South Africa has been introducing new occupations within the agricultural field, leading to a fragmentation and increasing specialisation of roles. Despite these changes, the practical expectations and conceptualisation of the extension officer's role in the field remain broad and encompassing.

This observation suggests a discrepancy between administrative creation of new occupations and their operationalisation. The introduction of new occupations by the DHET appears to be more of an administrative or theoretical exercise rather than reflecting changes in the actual operational dynamics of these occupational tasks. Practically, extension officers continue to shoulder a wide range of responsibilities, even though their official scope, as defined in policy documents, seems to be narrowing. This disparity indicates that the artificial creation of new occupations does not necessarily translate into a meaningful change in how these roles are executed on the ground, especially in the case of extension officers whose role continues to be vital and expansive in the agricultural sector.

5.6.3 Agricultural extension and VET policy concerning climate resilience

In response to the study's fourth objective (as detailed in section 5.6 of this chapter and Chapter 1, section 1.3) which is focused on examining agricultural extension and VET policy, as well as labour market data in terms of its climate resilience responsiveness, this section offers an analytical spotlight onto select policies on VET and extension. The primary aim is to discern the level of integration and emphasis placed on climate change within these policy frameworks. To provide a foundation for these findings, I reviewed four pivotal policies, as indicated in Table 5.5. This review seeks to shed light on the potential influence (or lack thereof) these policies might have on both extension practices and extension education within the context of Case 1. Setting the stage for this in-depth analysis, I begin by offering a concise overview of South Africa's policy stance on climate change.

5.6.3.1 Climate change in South Africa's policy

The analysis of policy documents regarding Extension and Climate change shown in Table 5.5 reveals an evident discrepancy in aligning policy initiatives with the actual training and

curriculum needs of the agricultural sector, as well as the extension and advisory services system.

Table 5.5. Climate change and extension-related policy objectives or interventions

Policy	Preferences to agricultural extension services	Policy references to skill for climate change resilience
<p>Presidential Climate Commission (PCC) (2022)- Framework for a Just Transition</p>	<p>The framework does not directly reference extension services but provides relevant skills development reforms for post-school education linked to the world of work, which include:</p> <p>(1) reskilling and upskilling existing adult workers so that they are better equipped to navigate the transition; (2) aligning the skills development system with the anticipated labour force needs of the future, particularly focused on green jobs to support a just transition; and (3) ensuring foundational skills through the education system to improve the adaptive capacity of the broader workforce</p>	<p>The framework provides for the agricultural sector to transition due to persistent climate-induced effects such as droughts, shifts in seasonal rainfall and intense rainfalls, which caused floods and worsened erosion, affecting farmworkers, animals and crops directly.</p> <p>The framework states that the extent to which farmers can more efficiently use water and adopt other climate adaptive practices and technologies will significantly influence impacts on the sector.</p> <p>Climate-induced changes in water availability are likely to have the most immediate and significant impact on the sector.</p>
<p>National Development Plan 2030 (2012)</p>	<p>The policy has no reference to extension service but references agriculture as facing low employment levels, and the policy proposes creating more jobs through agricultural development based on effective land reform and the growth of irrigated agriculture and land production.</p> <p>It also proposes increased investment in new agricultural technologies, research and the development of adaptation strategies for the protection of rural livelihoods and the expansion of commercial agriculture.</p>	<p>Policy observes climate change as a potential threat to South Africa’s food production and the availability of potable water, and livelihoods, especially among the poor, especially women and children.</p> <p>The policy calls for enhancing the resilience of people and the economy to climate change and to respond quickly and effectively to protect the natural environment and mitigate the effects of climate change.</p>
<p>National Climate Change Response White Paper (2011)</p>	<p>The policy has the following objectives;</p> <p>Invest in and improve research into water and soil conservation technologies and techniques, climate-resistant crops and livestock and promote the development of</p>	<p>The policy outlines priorities such as;</p> <p>Developing and implementing climate change education, training and public awareness, participations and access programmes to promote and facilitate scientific, technical and managerial skills to build climate resilience for addressing</p>

	<p>“climate-smart agriculture” that lowers agricultural emissions</p> <p>Use early warning systems to give timely warnings of adverse weather and possibly related pests and disease occurrence.</p> <p>Invest in education and awareness programmes in rural areas and link these to agricultural extension activities to enable both subsistence and commercial producers to understand, respond and adapt to the challenges of climate change. However, it makes no mention of agricultural extension</p>	<p>climate change.</p> <p>Mainstreaming climate change knowledge into education and training curricula and making climate change education part of the broader education for sustainability framework</p> <p>Ensuring that Sector Education and Training Authorities (SETAs) aggressively develop and fund climate change learnerships and internship programmes and other non-formal education and training programmes</p> <p>Include climate change elements in the review of the National Skills development Strategy and allocating research and training resources for students and scholars to study climate change</p>
National Skills Development Plan (2019)	The Policy highlights agriculture as one of the main economic sectors and indicates the need for training to target agriculture value chain among as one of more labour-absorbing activities. It however makes no mention of agricultural extension	The Policy has no reference to climate change. It prioritises improving the link between education and workplace through workplace-based learning. It observes VET as a vehicle for preparing students for the world of work, working closely with Sector Education and Training Authorities (SETAs) as intermediaries between education and labour market
White Paper for Post-school Education and Training (2013)	The Policy outlines the shift of responsibility of agricultural colleges from the Department of Agriculture to the Department of Higher Education and Training (DHET). Indicates the need for agricultural colleges to train for both private and public sector employment but makes no mention of agricultural extension.	The Policy makes no mention of climate change but proposes that to create sustainable jobs, skills in South Africa must be developed in the process of infrastructure development.
National Education and Training Strategy for Agriculture, Forestry and Fisheries (2015)	The Strategy identifies challenges in the agricultural sector including ineffective and non-responsive agricultural education and training (AET) system, poor access to the EAT by emerging farmers and new entrants in agriculture, and a shortage of critical skills. In response, the policy agitates for harmonisation and coordination between policy and curriculum development. It also states that AET at all levels is	The Policy recommends aligning the AET curricula with urgent challenges facing agriculture including water harvesting, and recommends training extension staff and teachers about this expertise sustainable agriculture. However, it does not mention climate change explicitly or offer what sustainable agriculture entails. It seems to over emphasise aspects of business management, post-harvest handling and economics and finance.

	<p>accredited and resourced with learners and teachers with relevant skills and suggests training teachers and extension staff in sustainable agriculture, water harvesting and land care and rural wealth creation</p>	
<p>National Policy on Extension and Advisory Services (2016)</p>	<p>Policy developed to link research, extension and producers to develop cross-cutting innovation for a diverse, resilient, productive and sustainable agricultural sector.</p> <p>To ensure a pluralistic and coordinated approach for providing extension and advisory services by public, private and non-profit organisations.</p> <p>Curriculum and education for extension practitioners lack emphasis on supporting diverse rural livelihood initiatives. The policy calls for a multi-disciplinary approach to training that capacitates current and future extension practitioners with relevant, diverse knowledge and tools to address farmer challenges.</p>	<p>The policy refers to the need for role players in agricultural sector to use environmental resources sustainably in order to advance the livelihoods, economic development and social welfare.</p> <p>The policy also mentions the need for cutting-edge innovation in agriculture and better linkages between researcher, extension and agent linkages to ensure resilient, diverse, productive and sustainable agricultural sector. However, there is no explicit mention of climate change</p>
<p>Agricultural Sector Skills Plan (SSP) (2022-2025)</p>	<p>The priorities for the policy include:</p> <p>Ensuring practical skills transfer through mentoring and on-the job training, improving quality and resources of agricultural extension services qualifications, focusing on entrepreneurship and enterprise development for emerging farmers and developing green knowledge qualifications.</p> <p>The Plan also identifies two issues with extension; a gap in skills of extension officers and lack of suitably qualified candidates in rural areas. Immediate interventions recommended to address this gap include the Agricultural Sector Education and Training Authority (AgriSETA) creating partnerships with institutions in the sector and other SETAs to improve the responsiveness of extension officers to the sector and offering a learning intervention of a national certificate</p>	<p>The Plan identifies climate change as one of the leading factors driving change and skills demand and supply in the agricultural sector due to increased climate-induced effects mainly drought. Climate change is expected to influence skills development in agriculture</p> <p>The SSP indicates need for developing sustainable farming processes supported by environmentally-conscious Principles as well as professional and research-based support and partnerships to develop relevant qualifications</p> <p>It further suggests that the challenges associated with climate change present the agricultural skills development sector the need to adjust to the contextual stresses of farming in a precarious ecological climate in the short-term and developing knowledge, technologies and skills that will allow for sustainable farming in the long term. The</p>

	in agricultural extension	<p>SSP recommends that the AgriSETA adopts a cross-cutting approach that promotes green knowledge across all sub-sectors and enterprise sizes. The qualifications developed must cater for subsistence to commercial farming.</p> <p>Finally, the Plan recommends that green knowledge be integrated in all agricultural learning programmes</p>
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Source: Author

Table 5.5 provides several key observations, with the first highlighting the Policy on Agriculture’s emphasis on pluralistic extension services and stakeholder coordination. The National Policy on Extension and Advisory Services advocates for a demand-driven, pluralistic approach to extension services, envisioning collaboration among various stakeholders, including government bodies, private entities, non-profits, and research institutions. The importance of well-coordinated stakeholders in agricultural skills development is further emphasised by the Agricultural Sector Skills Plan (AgriSETA, 2020), recommending that the Agricultural Sector Education and Training Authority (AgriSETA) collaborates with institutions and other Sector Education and Training Authorities (SETAs) to enhance the responsiveness of extension officers and learning interventions. Additionally, the National Policy on Extension and Advisory Services (DAFF, 2016) proposes a multi-disciplinary approach to training, aiming to equip current and future extension practitioners with diverse knowledge and tools to address farmer challenges. The policy advocates for a “pluralistic and coordinated approach” to offering extension services, involving the active participation of the public, private, and NGO sectors (DAFF, 2016, p. 7).

The second key observation underscores the significance of Vocational Education and Training (VET) in skills development within the agricultural sector, with a specific focus on agricultural colleges. The White Paper for Post-school Education and Training (DHET, 2013) reveals a strategic governmental shift, transferring the responsibility for agricultural colleges from the Department of Agriculture to the Department of Higher Education and Training (DHET). This move was intended to elevate the status of these colleges, positioning them as institutions of higher learning capable of offering interdisciplinary programs designed to prepare individuals for diverse roles in both the private and public sectors (p.25). The importance of VET is further

underscored in the National Education and Training Strategy for Agriculture, Forestry, and Fisheries (Department of Agriculture, Forestry, and Fisheries [DAFF], 2015). This strategy emphasises the need for harmonious coordination between policy and curriculum development to establish a responsive Agricultural Education and Training (AET) system. Moreover, it advocates for providing accredited qualifications and training for extension teachers and staff, specifically in the areas of sustainable agriculture and water harvesting. The National Policy on Extension and Advisory Services (DAFF, 2016) too recognises the potential for establishing a robust linkage between research and extension, aiming to foster a resilient and sustainable agricultural sector. The policy is dedicated to enhancing extension services within the agricultural sector and transforming agricultural training institutions into recognised centres of excellence.

The third observation is the clear intention and commitment of agricultural and climate change policies to foster climate resilience skills through VET. Notably, these policies recognise climate change as a major driver necessitating the development of climate-resilient skills in the agricultural sector. The Agricultural Sector Skills Plan (AgriSETA, 2020) explicitly identifies climate change as a leading driver influencing skills demand and supply in the sector. The policy recommends the development of environmentally friendly farming practices and the creation of relevant qualifications to cultivate climate-resilient skills and green knowledge applicable to all farmers, from subsistence to commercial. The integration of this expertise into learning programs is strongly encouraged. The Framework for a Just Transition (Presidential Climate Commission [PCC], 2022) acknowledges the adverse impacts of climate-induced effects, such as droughts, shifting planting seasons, and floods on agriculture. It suggests that farmers adopt climate-adaptive farming practices and technologies to mitigate these impacts. The National Climate Change Response White Paper (Department of Forestry, Fisheries and Environment [DFFE], 2011) highlights climate change as a pressing challenge for agriculture, necessitating urgent attention. The policy recommends investing resources in research on water and soil conservation to develop climate-smart agriculture that reduces greenhouse gas emissions. Additionally, it advocates for the development of early warning systems to provide timely alerts to farmers about adverse weather, pests, and disease occurrences. To foster climate resilience skills, the policy recommends investing in VET education to promote scientific and technical skills through formal and non-formal education and training programs in addition to ensuring public awareness, participation, and access to climate information.

A noticeable gap exists in some high-level climate, VET skills development, and agricultural policies, where extension services are either absent or inadequately acknowledged. Despite the White Paper for Post-school Education and Training (DHET, 2013) recognising the need for agricultural colleges to train labour for the public and private agricultural sectors, it fails to mention extension services as pivotal to the sector. Similarly, the Framework for Just Transitions (PCC, 2022) highlights the challenges faced by smallholder farmers due to climate-induced effects but barely acknowledges extension services as central to enhancing adaptive capacities. This absence or lack of acknowledgement of extension services in key policies reveals a form of policy myopia concerning the harsh realities as well as a deficiency in policy commitment to addressing the climate-related challenges faced by smallholder farmers and their desperate need to build climate resilience.

The fourth notable observation reveals prevalent policy contradictions between Agriculture and Climate policies and VET skills development in terms of messaging, focus, and priorities concerning climate resilience. Many policies on Agriculture and Climate underscore the imperative to integrate climate resilience skills into the education system and training curricula, with some specifically noting the importance of incorporating this expertise into extension services. For example, the Agriculture Sector Skills Plan (AgriSETA, 2020) emphasizes the need for skills development in agriculture to address ecological and climate stresses, advocating for the integration of green knowledge across all agricultural learning programs. Similarly, the National Climate Change Response White Paper (DFFE, 2011) outlines the necessity of developing and implementing climate change education and training, both formal and informal, to cultivate scientific and technical climate resilience skills. It also advocates for allocating resources for on-the-job training on climate change, such as internship and learnership programs, to foster climate resilience.

In contrast, policies on VET skills development do not mention extension and lack references to climate change as a priority area for the education system's focus. For instance, while the White Paper for Post-school Education and Training (DHET, 2013) highlights the need to create sustainable skills and jobs, particularly in agricultural colleges training for both private and public sector employment, it overlooks any mention of climate change. Similarly, the National Skills Development Plan (DHET, 2019) acknowledges agriculture as a major labour-absorbing sector and calls for improved links between education and the workplace through VET but makes no reference to extension or climate change. Intriguingly, although the National

Policy on Extension and Advisory Services (DAFF, 2016) emphasizes the need for a resilient and sustainable agricultural sector, it fails to explicitly mention climate change.

This finding reveals substantial contradictions between policies on VET skills development and agriculture and climate policies advocating for the integration of climate resilience expertise into education systems and curriculum. Such discrepancies highlight the need for a more cohesive and integrated approach to policy development, ensuring consistency and synergies between different sectors to address the complex challenges of climate resilience and skills development within the agricultural sector.

5.7 Chapter conclusion

The chapter provided an overview of the history underpinning laws, policies, and practices such as land dispossession and exclusionary extension education prevalent in pre-independence South Africa. These systemic biases were heavily weighted against Black and Indian farmers, resulting in implications for agricultural activities and extension services for these marginalised communities. The consequences of these discriminatory policies and practices persist in today's smallholder farmer communities, contributing to the enduring dualism observed in South Africa's agriculture, with stark disparities between struggling Black smallholder farmers and prosperous white farming communities. The chapter further shows that the historical trajectory of agricultural reform in post-independence South Africa illustrates the complexity of addressing historical injustices and building a more equitable and sustainable agricultural sector. The complexities are prevalent in policy implementation, underfunding, bureaucratic inefficiencies, and political changes, which have hindered the realisation of agricultural reform goals. There also ongoing controversies surrounding land reform, including debates over land appropriation without compensation and challenges in addressing traditional authorities' roles, highlighting the enduring legacies of apartheid and the entrenched inequalities in land ownership. Despite progress in certain areas, persistent challenges and complex socio-political dynamics continue to shape the country's agricultural landscape. This calls for designing effective policies and implementation mechanisms backed by political commitment. It also calls for continued dialogue, innovation, and concerted efforts towards a just and transformative change that prioritises social justice, economic empowerment, and environmental sustainability.

The empirical findings from the Alice case in South Africa highlighted the critical role of extension officers in climate resilience and the challenges the VET institution faces in preparing them for their roles. Findings revealed deficiencies in the curriculum of the Diploma in Agriculture at FCAFTI concerning the development of climate resilience skills. Moreover, examining the labour market information revealed a disproportionate focus on academic qualifications over practical core knowledge and tasks essential for effective extension work, which shows the need to shift to demanding core knowledge and skills as opposed to academic qualifications as the primary requirement. Finally, an analysis of occupational classification frameworks and their impact on the emergence or phasing out of agricultural occupations, including the extension officer occupation, highlighted the DHET's critical power in shaping these occupations, which are critical in skills planning and developing, and in this case, frameworks are not flexible enough to support climate resilience skills planning and development.

Policy analysis shows a strong emphasis on a demand-driven, pluralistic approach to extension services, which underscores the recognition of the diverse needs of farmers and the importance of collaboration and participation of various stakeholders, including government bodies, private entities, non-profits, and research institutions for practical skills development and planning for future skills. Finally, the contradictions in policies between agriculture and climate policies and VET skills development programmes regarding messaging, focus, and priorities concerning climate resilience underscore a gap in climate resilience skills development, calling for a more cohesive and integrated approach to policy development. Given the visible gaps in extension practice and labour market mismatch with policy as well as policy contradictions, it raises an important question of this thesis as to whether an occupation (in this case extension) is adequately constituted as a primary mediating unit of intervention for skills planning and skills development. To answer this question, these findings will be further discussed abductively in Chapter 7 where I related the insights to SEM and CHAT theoretical tools and through this provide further analysis. The next chapter offers analysis on the agricultural extension occupation from Uganda.

CHAPTER 6: EXTENSION SKILLS PLANNING AND DEVELOPMENT IN GULU, UGANDA

6.0 Introduction

Chapter 6 presents the findings related to the second case, set in Gulu, Uganda. Like Chapter 5, this chapter provides a background first by delving into the historical development of the extension occupation within Uganda, as this influences the case. This background then provides context for the empirical data from the Gulu case study collected through interviews with various stakeholders, including extension officers, farmers, and lecturers. In addition, the study analysed documents, mainly the study curriculum, and triangulated this with application of the Climate Resilience Assessment Tool. The Occupational Classification Framework (ISCO) was also analysed as well as relevant policies, as in Chapter 5. In this chapter, like chapter 5, I conducted the historical analysis and empirical research with a skills ecosystems perspective in mind to get insights into the skills ecosystem for Uganda and Gulu. This process included conducting a policy analysis to get insight into verticalities, curriculum review and gaining insights from experiences of extension officers and lecturers at VET institutions to get insight into mediation institutions and tools, and interviews with farmers to gain insight into horizontalities. These findings were critical for understanding the dynamics within the SEM for skills and its responsiveness to climate resilience. This analysis also helped to identify activity systems in the SEM for skills, which I abductively discuss in chapter 7.

Regarding the organisation of the chapter, from section 6.1, the chapter introduces an overview of Uganda's agricultural sector, followed by the history of agricultural extension services in sections 6.2 to 6.4, contributing to addressing the first two objectives of the study. These were to conduct a historical review of occupation as a mediating unit of intervention for skills planning and skills development (objective 1) and examine the current descriptions of the extension occupation (objective 2). Sections 6.5 to 6.7.3 shift the focus to the empirical findings, specifically addressing two more study objectives, 3 and 4. These objectives focused on how VET preparation for extension work takes place in response to the need for climate resilience (objective 3) and reviewing the responsiveness to climate resilience agricultural by extension and VET policy and the labour market (objective 4). Altogether, Chapter 6 offers a comprehensive picture of the agricultural extension occupation in Uganda by blending historical understanding with contemporary empirical evidence.

6.1 Overview of Uganda's agricultural sector

Agriculture is crucial to Uganda's economy, food security and livelihoods. A 2018 report by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) revealed that agriculture employs over 80% of the rural population. In addition, the sector employs over 70% of the workforce, contributing to a quarter of Uganda's GDP and accounting for 85% of its exports (World Bank, 2021b). However, there is growing concern about the sector's productivity. The National Development Plan (III) (National Planning Authority, 2020) indicates that the sector missed its 6% growth target for 2015-2020. Specifically, key crops like maize, cassava, and bananas grew by 3.7%; cash crops like coffee and tea by 6.4%; and the livestock sector witnessed a mere 2.2% growth (National Planning Authority, 2020).

Uganda boasts a vast crop diversity, thanks to its 11 diverse agroecological zones, each with distinct farming systems, including Gulu which is the specific case study site for this research. Factors like soil variety, climatic differences, and cultural and socio-economic factors drive this crop diversity (MAAIF, 2018). Nevertheless, despite its rich arable potential, Uganda's agricultural output remains stunted. Numerous reports highlight a paradox: while the country enjoys abundant water and a favourable climate, this has not yielded significant benefits for the poor. The primary reason is continued reliance on outdated farming techniques (MAAIF, 2018; World Bank, 2021b). Coupled with unpredictable rainfall and mounting climate challenges, like droughts and floods, these rudimentary practices threaten the sector's foundational role in Uganda's economy and livelihoods (MAAIF, 2018; World Bank, 2021b).

Recognising the urgency, Uganda has actively engaged in initiatives and partnerships to bolster the agricultural sector against climate change. A notable step was its endorsement of the Comprehensive Africa Agricultural Development Programme (CAADP) under the African Union. CAADP aims to eradicate hunger, reduce poverty, and spur economic growth through agriculture-related strategies (African Union, 2022). Its agenda rests on four pillars: enhancing agricultural research, technology, and dissemination; promoting sustainable land and water management; improving rural infrastructure and trade capacities; and increasing food supply while curtailing hunger. The programme also emphasises building resilience against climate change by strengthening disaster readiness and crafting early warning systems (African Union, 2022).

Aligned with such international blueprints, Uganda's National Development Plan (NDP III; 2021-2025) identifies agriculture as the anchor for driving economic growth, mitigating

poverty, and fostering employment (National Planning Authority, 2020). With an ambitious goal of absorbing most of the 700 000+ new labour force entrants annually in the agricultural sector, the plan projects the creation of over 800 000 jobs by 2025 across agriculture, forestry, and fisheries. Realising these ambitious plans mandates a shift towards agro-industrialisation, trimming post-harvest wastage, and mitigating disaster-induced losses (National Planning Authority, 2020).

The effective implementation of the NDP's blueprint rests on robust agricultural extension services, which are vital to disseminating research and innovations to farming communities. With a pivotal role in uplifting smallholders, a historical account of agricultural extension in Uganda needs exploration, as outlined in the subsequent section.

6.1.1 Brief history of agriculture and extension education in Uganda

Before the 1890s, the inhabitants of early areas in what is now Uganda were predominantly hunter-gatherers. Over time, their societies transitioned into ones centred around domestic farming, particularly in the southern part of the country around Lake Victoria (formerly known as Nalubaale), as documented by Marchant (2022). Concurrently, the northern part of Uganda was characterised by communities dominated by pastoralists and nomads (Krätli, 2010). In this agrarian landscape, families were landowners who tilled and cultivated the land, relying on their extensive family networks. Patrilineal and polygamous traditions characterised the societal structures in Uganda. Families collaborated within these frameworks to cultivate the land and produce food crops, forming the backbone of their sustenance using indigenous knowledge and practices (Marchant, 2022).

Families also cared for domestic animals, including cattle, goats, sheep, and chickens. In this context, the main focus of agricultural activities was domestic consumption, with limited trade occurring between families through a barter system. Families exchanged commodities they possessed for those they lacked, fostering mutual support and resource sharing (Mamdani, 1996). The nomadic communities engaged in the seasonal movement of livestock in search of water and pastures, primarily herding cattle (Krätli, 2010). This traditional way of life faced significant disruption with the advent of colonialism in the late 1800s when Uganda became a British protectorate. The imposition of colonial rule brought about profound changes to the existing socio-economic and cultural structures and reshaped Uganda's history and development of agriculture.

Following the introduction of British colonial governance in 1894, formalised agricultural education in Uganda began in 1911 with the establishment of the Department of Agriculture to support the cultivation of colonially introduced economic crops like cotton and coffee. These activities faced challenges due to conflicts between the Buganda and Busoga regions, which affected crop cultivation and initial agricultural training efforts (Staples, 1939). With British intervention, the conflicts were managed, allowing for increased cotton production. To further this cause, the colonial government distributed seeds and instituted experimental farms in Jinja and Naminage. These farms were designed to identify suitable cotton varieties and served as training centres for agricultural techniques (Nayenga, 1981). To bolster agricultural education and commodity crop cultivation, a hierarchical administrative system was set up. This system involved chiefs who, understanding the significance of education in managing such responsibilities, were encouraged to attend schools like Kamuli in Busoga and Kings College Budo in Buganda (Nayenga, 1981).

By 1925, there was a significant shift in the administrative structure. The first Director of Education in Uganda established the Department of Education and appointed an officer to oversee agricultural education, aligning it with Makerere College which by then was affiliated with the University College London in the United Kingdom (Staples, 1939). This resulted in a rapid expansion of agricultural training. By 1930, Bukalasa and Serere emerged as key centres of agricultural instruction (Jjuuko et al., 2019). In 1933, comprehensive two-year courses for potential farmers were introduced, with missions like the Church Missionary Society offering additional support and training (Elliott, 1939).

The post-independence period, particularly between 1964 and 1971, saw a renewed emphasis on agricultural education, focusing predominantly on extension. With support from international agencies, such as USAID, existing agricultural institutions were fortified, and new ones emerged. Their primary goal was to provide a hands-on, practical curriculum to foster a generation skilled in modern agricultural practices (Semana, 2008). Today, agricultural education in Uganda is comprehensive, encompassing formal TVET colleges, universities with VET components, and practical industry-based learning settings (Jjuuko et al., 2019).

6.2 Historical sociology of Uganda's agricultural extension services

In Uganda, extension services have seen significant transformations and serve as a case study for agricultural extension systems across Sub-Saharan Africa (Chapman & Tripp, 2003). This

Agricultural Extension Services (AES) transformation has undergone a series of achievements and obstacles over the past century, as highlighted by Nkonya et al. (2020). Historically, Uganda's agricultural extension research and development journey can be categorised into multiple stages. Semana (1998) mapped out seven development stages, starting from 1898 to 1998. Building on this foundational work, Nkonya et al. (2020) identified two additional, more recent phases: 1999 to 2009 and 2010 to 2019. These shifts in the extension services over time have not occurred in isolation. They have been influenced and shaped by a myriad of factors, including political transitions, policy overhauls, comprehensive land reforms, and shifts in the country's socio-economic landscape. Detailed descriptions of extension development phases follow in the sections below.

6.2.1 Colonial era (1898-1907)

The colonisation of Uganda by the British in 1884 profoundly reshaped its agricultural landscape and extension services. A critical policy reform that fostered this transformation was the 1900 Buganda Agreement, particularly in Central region occupied by Buganda Kingdom. Mamdani (1996) notes that this pact transformed the existing hierarchy and elevated the pre-colonial ruling class into a land-based aristocracy. The British colonial administration intended to enhance Uganda's agriculture potential, particularly emphasising the export of lucrative crops such as coffee, cotton, and tea in service of the colonial economies. The agreement allocated expansive land equivalent to 10 034 square miles (locally known as *mailo*) to the Buganda Kingdom's royalty and the most influential chiefs. Another 8 000 square miles were also awarded to the lesser chiefs and other dignitaries in the Buganda kingdom (Mamdani, 1996).

Consequently, this land demarcation turned ordinary people into rent-paying tenants, living on lands owned by *mailo* landlords. The colonial landscape also saw a growing number of European settlers venturing into agriculture beyond Buganda Kingdom to include other areas such as Busoga (Nayenga, 1981). These settlers became the primary buyers of cotton cultivated by Ugandan peasants. However, this era of European farming was short-lived in Uganda. As Mamdani (1996) pointed out, local peasants emerged as a more efficient and economical source of cotton, satisfying the high demands of the Lancashire textile mills.

It is important to highlight that the policy reform discussed primarily pertained to Buganda and did not extend to other regions in Uganda. However, it is worth acknowledging that colonial

influence on agricultural practices, particularly the cultivation of cash crops like cotton and coffee, was widespread across various parts of the country, including Acholi (where Gulu is located), Busoga, and the western region. While Buganda may have been at the forefront of certain land policy changes, the impacts of colonial agricultural policies were felt nationwide and shaped the agricultural landscape and extension in various ways.

This colonial phase introduced an era of agricultural extension that favoured the integration and promotion of foreign technologies. Sadly, this approach overlooked rich indigenous knowledge and agricultural practices. Nkonya et al. (2020) affirmed that these extensions often pushed peasants to embrace imported technologies, sidelining native methodologies and indigenous knowledges and practices. Delgado (1995) further indicates that the colonial mindset was obsessed with the belief that Western technology would substantially boost agricultural production. As a result, the focus of agricultural extension during the colonial era became the dissemination and implementation of these ‘modern’ techniques (at the time).

6.2.2 Colonial policy enforcement era (1920-1956)

As indicated above, under British colonial rule, Uganda’s agricultural sector experienced a shift partly marked by the introduction of commodities and a regulatory model of agricultural development. This restructuring of agriculture was intertwined with the broader objectives of the colonial government for Uganda’s agriculture. Agricultural extension services at the time fell under the purview of the colonial government. To ensure the implementation of these services, the government appointed traditional chiefs and supported them with a few trained agricultural officers to oversee operations (Bukonya, 2010). These chiefs had two roles: to supervise and guide agricultural practices in their respective regions and collect taxes from the peasantry on behalf of the colonial administration.

The commodities introduced, mainly cotton and coffee, were dictated by colonial demand. To facilitate this, chiefs distributed agricultural inputs and provided instructions on cultivation methodologies, as directed by colonial guidelines (Bukonya, 2010). The extension system was rooted in coercion, with the primary motive of maximising revenue, known as ‘*busulu*’, for the colonial government and the local chiefs (Mamdani, 1996). Consequently, the by-laws constrained farmers, forcing them to produce specific cash crops using imposed practices. For instance, extensionists heavily promoted soil and water conservation to the extent that farmers often felt compelled to construct conservation structures, irrespective of their traditional

agricultural knowledge (Nkonya et al., 2020). This regulatory system brought its own set of challenges. As production flourished, landlords, keen to maximise their profits, began extracting both commodity tax (*'nvujo'*) and ground rent (*'obusulu'*). This financial pressure compelled tenants (peasantries) to reduce their commodity production, primarily cotton. The discontent led to a revolution spearheaded by clan heads, demanding land reforms and a re-examination of the 1900 Buganda agreement (Mamdani, 1996).

In response, the colonial administration introduced the 1928 Land Bill. It was a remedial measure addressing the contentious *mailo* land system, which the Governor saw as increasingly problematic (Mamdani 1996). The reforms curtailed the power of landlords, granted peasants protective and inheritance rights, and restricted tenants to only three acres. Though the reform sought to offer a middle path, neither endorsing freehold nor landlordism, it unfortunately, retained the coercive farming directives. Farmers, especially those cultivating coffee, faced harsh methods that left deep psychological scars (Nkonya et al., 2020). The farmers resented this system to the extent that upon Uganda's independence, many destroyed the very conservation structures they had been forced to create, a clear statement of rejection of the colonial agricultural legacy.

6.2.3 The use of model farms and progressive farmers (1956-1963)

From 1956 to 1963, Uganda's agricultural extension services witnessed a transformative phase designed to reduce the dominance of traditional chiefs in agricultural guidance. Instead, a new approach was adopted. This involved identifying and nurturing 'model farmers' who would serve as examples for progressive farming techniques. Supported by the extension agents with input and credit facilities, these farmers were tasked with establishing 'model farms', which would then act as live demonstrations for the wider farming community to learn from and replicate (Kidd et al., 2001). The rationale behind introducing this model was rooted in technology transfer. By leveraging early adopters, or 'progressive farmers', the colonial administration aimed to drive technological adoption, hoping that this would increase agricultural production and productivity (Thompson & Scoones, 2009). However, expectations did not materialise practically. The extension system struggled, hampered by inadequate service providers and a growing scepticism among the farmers. They viewed these so-called 'progressive farmers' with suspicion, considering them a privileged class whose practices they could not possibly replicate (Nkonya et al., 2020). This mistrust was exacerbated when some

progressive farmers, perhaps viewing their knowledge as a competitive advantage, chose not to disseminate information freely among other farmers. While the influence of traditional chiefs had reduced, they were not entirely sidelined. The colonial administration, recognising the strength of their existing networks and their capability to enforce by-laws, continued to engage with them in an agricultural capacity (Bukenya, 2010). Despite the changes in extension methods, the period marked a rise in commodities meant for export. Unfortunately, this export surge did not translate into tangible agricultural growth for Uganda, a discrepancy highlighted in the 1993 World Bank report.

6.2.4 The post-independence phase (1964-1971)

From the early 1960s to 1970, Uganda experienced significant changes, with the nation gaining independence in 1962. The newly formed government inherited an extension system from the colonial regime, which had unfortunately gained resentment among the farmers. This resentment was due to the traumatic legacy of the enforced cultivation of commodity crops, commonly called '*kiboko*' or cane, in which farmers would be caned if they refused to cultivate commodity crops.

In response to this, the government changed towards an extension and advisory approach that focused on disseminating technological innovations in farming (Nkonya et al., 2020). During this phase, there was a marked emphasis on formalising agricultural education. New agricultural institutions were established, while pre-existing ones received upgrades to impart a more practical and hands-on curriculum. The ultimate objective was to nurture a workforce well-experienced in modern agricultural practices (Semana, 2008).

A significant endorsement of this approach came from international agencies, particularly USAID. In the wake of the decolonisation wave, many developing countries, including Uganda, received development aid. USAID's aid in Uganda aimed to initiate farm institutes across all districts. Consequently, extension services expanded their reach, promoting non-export agricultural practices tailored for smallholder farmers. Additionally, extension officers stationed at administrative hubs provided diverse services that spanned forestry, livestock, and crop production, aiming to usher in an era of multi-disciplinary agricultural growth (Ellis & Biggs, 2001; Ruhode, 2013).

Central to this model was the aspiration to create a link between research, extension services, and farmers to foster a climate conducive for technological innovations. However, this vision, despite its promise, did not fully materialise. A significant barrier was the discord in extension

messages disseminated by various line ministries, which, as Nkonya opines, led to “weak harmonisation” (Nkonya, 2020, p. 143).

6.2.5 The stagnation period between 1971 and 1980

From the start of the 1970s, following Idi Amin’s coup, Uganda’s agricultural extension services experienced a period of stagnation and inefficiency. Dubbed the “non-directional period”, this era was characterised by widespread systemic breakdowns. A mix of civil unrest, economic mismanagement, the disintegration of the export sector, acute foreign exchange shortages, and the collapse of commercial agriculture became the defining feature of this turbulent phase (Bukonya, 2010; Nkonya et al., 2020).

The absence of a coherent agricultural policy only exacerbated the situation. This void in leadership and direction led to a devastating impact on Uganda’s research and extension systems. Critical linkages that once existed between research, extension and farmers were shattered (Semana, 1998). This disintegration had tangible effects on Uganda’s agricultural productivity. According to the Ministry of Agriculture, Animal Industry and Forestry (2018), a dark picture emerged, where the nation’s agricultural growth plummeted drastically. Before 1971, Uganda enjoyed an impressive average annual growth rate of 10% in its agricultural sector. Post-coup, this figure declined to a meagre 2% per annum. This period in Uganda’s agricultural history serves as a reminder of the complex interplay between political stability and agricultural productivity.

6.2.6 The recovery period (1981-1991)

The period following Amin’s ouster in 1979 signalled the revival of agricultural extension services in Uganda during the 1980s. Endorsed by the World Bank, many countries shifted towards demand-driven extension models, while Uganda retained its top-down approach. This approach centred on the dissemination of technologies but did not take significant inputs from smallholders, particularly evident during the civilian regimes between 1980 and 1985 (Swanson, 2008).

The Ugandan government spearheaded economic recovery programmes in this era, particularly emphasising revitalising the agricultural sector. The intent was to foster a symbiotic relationship between research and extension through training (Nkonya et al., 2020). Some

revitalisation strategies included supplying agricultural inputs and lending extension support through chosen governmental agencies. These measures bore fruit briefly. As the 1993 World Bank report indicated, the agricultural sector's contribution to economic growth spiked to 17% between 1981 and 1983. However, this progress was brief and was ravaged by renewed political instability in 1985 and 1986.

In 1986, a phase of relative calm ensued under a new regime of the National Resistance Movement. To address the overlapping roles and inefficiencies in the extension services, which had been left by years of instability, the government merged the Ministries of Agriculture and Animal Industry, birthing the Ministry of Agriculture, Animal Industry and Fisheries (Semana, 2008). This unification aimed to “rationalise, integrate, and harmonise the use of scarce resources as well as to professionalise extension education through learning and teaching” (Nkonya, 2020, p. 144). Consequently, a more inclusive form of extension emerged that valued and integrated farmers' indigenous knowledge.

However, these improvements faced challenges. Despite the initial promise, the extension services of the 1980s were curtailed due to diminished agricultural budgets. The structural adjustment programmes endorsed by the World Bank were particularly detrimental, as they lacked a robust agricultural focus, weakening the strides made in the sector (Swanson, 2011).

6.2.7 The introduction of institutional reforms (1992-1998)

The 1990s in Uganda were pivotal for agricultural extension services, characterised by a paradigm shift from conventional models. Recognising the flaws of prior approaches, the government ventured into more dynamic models – the agricultural knowledge and information systems model and, subsequently, the innovations concept model (Rivera & Sulaiman, 2009). These models marked a departure from unidirectional communication, fostering a collaborative environment where extension officers and government research agencies played the role of knowledge facilitators in dialogue with farmers. With the backing of the World Bank, the 1990s saw agricultural extension primarily as an educational undertaking, operating under a consolidated service delivery model (Nkonya et al., 2020). A key feature was the enhanced synergy between research and extension, designed to foster the flow of information. Farmers were regularly updated, typically monthly or bi-monthly, in alignment with the training and visit system. However, this momentum faced considerable obstructions. The same World Bank ironically championed the unified extension system and simultaneously backed a series of

reforms pushing for privatisation, liberalisation, and decentralisation, along with a restructuring of the Ministry of Agriculture. The repercussions were swift and led to a significant reduction in extension agents, and by 1998, there was a staggering extension officer-farmer ratio of 1:1 800 (Semana, 1998).

Furthermore, as part of the decentralisation reforms, the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) delegated many of its responsibilities to district levels. In theory, this move sought to bring services closer to the grassroots. However, in practice, many districts grappled with executing these new roles, leaving a gap in the delivery of extension services. Farmers, once hopeful of more beneficial extension services, found themselves struggling to navigate a complex system and access the support they desperately needed.

6.2.8 Implementation of institutional reforms (1999-2009)

The disruptions in Uganda's agricultural extension systems opened doors for non-governmental organisations (NGOs) to deliver extension services. As a result of these institutional vacuums, NGOs introduced various participatory approaches to extension (Chipika & Friis-Hansen, 2004). This was a significant shift from the previous top-down, government-led models. The participatory approach, which prioritised farmers' insights and demands, gained traction and soon became embedded in the national extension services system, championing the demand-driven extension model (Nkonya et al., 2020).

A significant step in this transformation was the 2001 establishment of the National Agricultural Advisory Services (NAADS). Operational between 2001 and 2014, NAADS represented a paradigm shift – transitioning from a supply-driven, public sector-implemented model to a more inclusive, demand-driven, yet publicly funded extension service (MAAIF; 2016). This was not an isolated initiative but formed part of the broader agenda for Uganda's poverty alleviation, particularly the Plan for Modernisation of Agriculture (PMA). Furthermore, NAADS extended its services beyond the rudimentary, incorporating overlooked aspects like post-harvest handling and marketing (Nkonya et al., 2020).

With its multilayered strategies, this renewed approach motivated private sector interest in diverse aspects of agriculture – from extension to production, processing, and even marketing. During this period, numerous agricultural extension and advisory models flourished. Prominent ones include the Farmer Field Schools by FAO, the Farmer to Farmer (F2F) model by ICRAF, the One-Stop Centre Association (OSCA) method by Sasakawa Global 2000, and market-

centric models like Access to Market (ATM) and Business to Business (B2B) by ExcelHort (MAAIF, 2016). Each of these sought to simplify the complexities of learning, technology adoption, innovation, and information dissemination. However, even with such multifaceted strategies and substantial investments, NAADS faced challenges. In 2014, the President abruptly discontinued NAADS due to its inability to usher in the much-anticipated agricultural transformation. The ambitious vision had been set, but the transformative reality remained intangible.

6.2.9 The pluralism in the agricultural extension service system (2010–2023)

The failure of the NAADS programme can be attributed to a series of misconceptions, misjudgments, and gaps in design and implementation. Upon closer examination by an inter-ministerial committee, several significant issues were identified (MAAIF, 2016):

1. **Misaligned design and reality:** While NAADS was conceptualised to run concurrently with the seven pillars of the Plan for Modernisation of Agriculture (PMA), only two of these pillars were active. The overload of responsibilities, beyond just extension, was harmful to the NAADS programme.
2. **Staffing assumptions:** The programme assumed that public extension officers would transition into a robust private sector. This transition was never realised, causing a disconnect between planning and execution.
3. **Capacity underestimation:** The belief that local governments possessed the technical know-how to run the programme was inaccurate. The decentralisation process was still immature, and local governments grappled with capacity deficiencies.
4. **Farmer readiness:** A significant assumption was that smallholder farmers were prepared to demand and control services. On the ground, this was not the case.
5. **Lack of financial provisions:** The programme anticipated cooperation between different institutions. However, there were no financial mechanisms to ensure this collaboration.
6. **Rapid implementation:** Instead of a phased, learning-oriented approach, NAADS's roll-out was rushed. This meant that there was little room to adapt and improve based on early lessons.
7. **Conflicting roles:** Due to mixed messaging and external influences, NAADS often extended its mandate, especially in areas like procurement and distribution of agricultural inputs.

The 2014 restructuring of NAADS marked a major shift in the nation's agricultural strategy. Agricultural coordinators were replaced by officers from the Uganda People's Defence Forces (UPDF) who underwent brief training at Makerere University (Mukembo & Edwards, 2015). With the UPDF at the helm, the programme transitioned to Operation Wealth Creation (OWC), laying the foundation for a new era of agricultural extension management. The painful lessons from NAADS's mistakes served as crucial building steps. The Ministry of Agriculture, Animal Industry, and Fisheries leveraged these insights to formulate the new National Agricultural Extension Policy (2016-2021). Accompanying this policy, the 2016 guidelines⁹ established a clear direction for the role of extension officers in Uganda, aiming to avoid past mistakes and build a sustainable and effective agricultural extension system. The subsequent section details the roles of extension officers, indicating a renewed focus and commitment to advancing Uganda's agricultural sector. The next section briefly discusses the training and professionalisation of extension and advisory professionals in Uganda.

6.3 Extension education, training and professional development

Agriculture in Uganda has historically been informal, with the exception of a few commercial entities. This has cultivated a prevalent notion, especially among youth, that careers in agriculture, particularly in extension services, are less prestigious and undesirable (Sumberg, Anyidoho & Chasukwa, 2015). This perception is further supported by an ODI report which states that youth equate agricultural work with manual labour (Overseas Development Institute, 2016). Yet, many young Ugandans turn to agriculture out of necessity, given the lack of other opportunities (Brooks et al., 2013). To this end, the government has embarked on measures to reinforce the agricultural extension system. As detailed by the National Planning Authority, there are aspirations to transition the focus of extension services from research hubs to actual farming sites and impart entrepreneurial skills and cooperative farming into colleges of commerce (National Planning Authority, 2020). Part of this strategy envisages the integration of technological innovations, including e-extension and digital marketing within agriculture. Promisingly, there is an increase in youth pursuing agricultural careers across various segments, including extension and food industries (James & Denis, 2015). This is reflected in

⁹ Extension services guidelines in Uganda: <https://agriculture.go.ug/wp-content/uploads/2019/04/Agricultural-Extension-Services-Guidelines.pdf>

the rise of students enrolling in agricultural courses at prominent TVET institutions¹⁰ and other universities like Makerere University, Gulu University which offer study programmes with TVET components. The continuous growth of Uganda's agricultural sector depends on rebranding agriculture from merely a subsistence activity to a professional and business-oriented vocation. For this transformation, equipping the youth with the right skills and mindset is paramount. As Jjuuko et al. (2019) emphasised, the future of agriculture lies in the hands of passionate, yet professionally trained individuals. However, some challenges still remain in Uganda's education system affecting agriculture and extension education.

In 2011, Uganda's Ministry of Education and Sports (MoES) recognised a significant gap in the Business, Technical, Vocational Education and Training (BTVET) system: graduates often lacked practical competencies (MoES, 2011). This observation was corroborated by a World Bank report the following year, which highlighted feedback from Ugandan employers lamenting that training programmes were not adequately preparing students with hands-on skills and relevant job competencies (World Bank, 2012). This disconnect between theoretical knowledge and practical application was further highlighted in tertiary Agricultural Education and Training (AET) institutions, where agriculture is primarily taught from a theoretical standpoint with limited hands-on experience for students (Jjuuko et al., 2019).

To evolve Uganda's agricultural sector, robust institutional frameworks are imperative. These institutions need to focus on fostering both extension education and ongoing professional development in light of the rapidly changing agricultural landscape and labour market demands. Such dedicated efforts can instil a sense of commitment and excellence among extension professionals, ensuring they serve passionately. As highlighted by Jjuuko et al. (2021), the agricultural industry requires individuals who not only excel in their roles but also possess a genuine passion for their work. Yet another significant impediment remains: Uganda's absence of a consolidated national professional body for extension specialists that could shape policies effectively and enforce professional standards such as qualifications and competencies. Although multiple grassroots associations exist, initiated by the extension officers themselves, and local branches of international bodies like African Forum for Agricultural Advisory services¹¹ (AFAAS) and Young Professionals for Agricultural

¹⁰ See a list of TVET institutions offering agriculture and extension qualifications in Uganda. <https://www.education.go.ug/wp-content/uploads/2021/11/List-of-Government-Institutions-with-courses-districts-and-constituencies.pdf>

¹¹ AFAAS has various local branches in over 12 countries in Africa building capacity of extension and advisory professionals <https://www.afaas-africa.org/>

Development¹² (YPARD) operate, their influence is fragmented. This fragmentation is further observed in other capacity-building providers, ranging from NGOs to public entities like MAAIF (AFAAS, n.d. a). The disjointed nature of these organisations makes it challenging to enforce consistent professional standards. While the Directorate of Agricultural Extension Services (DAES) oversees public extension agents, ensuring they meet the prescribed professional criteria, the private sector largely operates independently, though with some advisory input from DAES. In Uganda, extension officers and other agricultural professionals are expected to provide essential support to the growing number of farmers. The following section highlights the roles of extension officers as conceptualised in national policy.

6.3.1 Extension officers' role in Uganda's agricultural extension framework

Agricultural extension services in Uganda represent a collaboration between the government and the private sector. The government identifies private agricultural extension entities as fundamental non-state actors within the agricultural value chain. This spectrum includes private corporations, non-governmental organisations (NGOs), and agro-input suppliers and dealers. The guidelines issued for the execution of extension services outline the roles and interventions of both governmental and non-state actors (NSAs) in the sector. As presented by Ministry of Agriculture, Animal Industry and Fisheries (MAAIF, 2016), the essence of these guidelines is to ensure that extension services expertly facilitate farmers and various value chain stakeholders in accessing vital knowledge, technological insights, and data. Furthermore, they aim to act as intermediaries for these farmers to interact seamlessly with relevant organisations.

As outlined in the Extension Services guidelines (MAAIF, 2016, p. 9), the Directorate of Agricultural Extension Services anticipates that extension officers in Uganda should:

- Mobilise and register farmers into production and marketing groups, assess their needs and design appropriate training sessions so that they can benefit from agricultural extension services.
- Train farmers in technical and group dynamics and leadership skills for improved production and productivity of crops, livestock and fisheries, for example, the control

¹² Read more about YPARD here: <https://ypard.net/resources/blog/empowering-young-farmers-through-the-ypard-uganda-caf>

of soil erosion and conserving soil and water to mitigate the effects of climate change on proper nutrition.

- Demonstrate land preparation, planting, management of crops (fertiliser application, pruning, mulching, etc.), proper animal management, post-harvest handling, value addition and marketing.
- Facilitate partnerships and linkages to other value chain actors, such as input dealers, traders, processors, and financial institutions.
- Advise farmers how to harvest water for livestock and crop production by digging ponds and demonstrating simple irrigation technologies appropriate to smallholder farmers.
- Conduct exchange visits and study tours for farmers to learn from other farmers who have excelled in certain technologies or enterprises; and
- Attend district-level activities in agriculture and cross-cutting issues organised by the Production Department or other collaborating organisations.

As Uganda strives to ensure food security and sustain its agricultural growth trajectory, the role of extension officers becomes even more vital. They are not simply disseminating knowledge but are actively shaping a future where agriculture thrives in harmony with nature, resilient to the adverse conditions of a changing climate. This will be realised if the government addresses some of the challenges still impeding the seamless provision of extension services in the agricultural sector. The following section discusses the challenges confronting both Uganda's agriculture and extension services.

6.4 The challenges facing Uganda's agriculture and extension

Agriculture and extension services in Uganda are confronted with diverse challenges and risks that have severely affected the sector. Therefore, there is an urgent requirement for the implementation of sustainable skills development and financial investments in extension services.

Firstly, extension officers are limited by transportation due to infrastructural challenges. The accessibility of remote villages substantially impedes the mobility of extension agents, thereby constraining their capacity to engage effectively with these locations (McCole et al., 2014). Furthermore, several organisational hurdles limit the operational scope of numerous

government-based Extension and Advisory Services (EAS) agencies. Since 2001, the responsibility for executing Uganda's agricultural extension and advisory services had been vested in the National Agricultural Advisory Services (NAADS). Unfortunately, NAADS was overwhelmed by various challenges encompassing financial mismanagement, embezzlement, and an atmosphere of policy ambiguity (Naluwairo, 2011). Currently, NAADS operates under the Operation Wealth Creation umbrella, whose effectiveness is yet to be evaluated.

Moreover, the diffusion of agricultural information among Ugandan farmers is hindered by a significant prevalence of illiteracy. This poses a notable challenge in distributing written materials for delivering extension services. Notably, Naluwairo (2011) has reported illiteracy rates ranging from 30% to even 50% in some areas of Uganda. This widespread illiteracy obstacle has presented considerable impediments for field extension agents. Consequently, extension and advisory service providers have turned to information and communication technologies (ICTs) such as text messages, radio broadcasts, and phone applications to disseminate agricultural knowledge (McCole et al., 2014). However, due to economic constraints, implementing ICTs in remote areas has been restricted mainly to radio usage, with a gradual surge in the popularity of mobile phones. While radios have been acknowledged as effective tools for information dissemination in rural contexts, conveying agricultural extension information through radio channels is accompanied by challenges like signal deficiencies, unidirectional communication, and the lack of financial resources among impoverished farmers to sustain continuous radio operations (Nazari & Hasbullah, 2010).

The agricultural sector itself is allocated limited financial resources within the national budget. According to the National Planning Authority (2020), extension services in Uganda currently lack sufficient support for crucial agricultural aspects, including entrepreneurship training, innovation, and research. This deficiency is reflected in the low technology adoption rates (4% among Ugandan farmers) and a prevailing view of farming as a non-business undertaking, primarily due to inadequate entrepreneurial skills and staffing challenges. Consequently, the lack of sufficient budgetary allocation has caused reductions in the extension officer workforce, resulting in a high extension officer-to-farmer ratio (McCole et al., 2014). As evidenced by the 2008 National Service Delivery survey, spanning the 12 months antecedent to the survey, a mere 14% of agricultural households reported instances of interaction with extension agents (UBOS, 2008).

Another impediment to agriculture and extension is farmers' lack of sufficient access to credit facilities and inputs. The initiatives available from the government of Uganda provide financial services to farmers but are non-transformative, uncoordinated, and scattered across different government departments (National Planning Authority, 2020). Furthermore, conventional financial institutions emphasise low-risk investments characterised by substantial cash inflows and collateral security, thereby sidelining agro-based enterprises. The resulting deficiency in credit access constrains investments in agricultural production, particularly disadvantaging smallholders predominantly engaged in primary production activities.

In addition to the challenges mentioned above, Uganda grapples with substantial risks linked to climate change. The variability in climate patterns poses significant present and future challenges for Uganda's agricultural sector. Highlighting this vulnerability, the National Adaptation Plan for Agriculture (NAP-Ag) underscores the sector's exposure to climate-related impacts on crops, livestock, and fisheries, primarily due to the rainfed nature of agriculture in Uganda. The climate report published by the World Bank on Uganda explicates that climate change is poised to exacerbate challenges concerning pests and diseases in rice and fungal and viral blights in crops such as bananas, beans, and coffee (World Bank, 2021b). Furthermore, it predicts that irregular rainfall patterns could heighten risks associated with post-harvest storage, a predicament already manifest within the country. Some reports have suggested that the rural farming population lacks organisation and faces challenges in effectively managing post-harvest activities. Most people lack adequate modern storage facilities, thereby compromising produce quality (MAAIF, 2018; Tibagonzeka et al., 2018). According to Tibagonzeka et al. (2018), post-harvest losses account for 30 to 40% in grains and other staples and 30 to 80% in vegetables and fruits. This backdrop finds alignment with Uganda's National Development Plan (III), which acknowledges the escalating severity and recurrence of droughts as instigating crop failures. Notably, the augmented incidence of flooding and landslides is ascribed to escalating deforestation rates and the concurrent degradation of wetlands and arable land (National Planning Authority, 2020).

Furthermore, climate-induced impacts have resulted in a reversal of prosperity and increased poverty levels within communities reliant on crop farming. Given Uganda's predominantly agricultural nature, these climate-related risks have far-reaching implications for overall economic growth and employment rates (National Planning Authority, 2020). In the longer term, the effects of climate change could lead to a reduction in Uganda's national food crop production by the year 2050, mainly affecting staple crops such as cassava, groundnuts, maize,

and millet (World Bank, 2021b). The potential consequences of this decline could amount to a cost exceeding \$1.5 billion for the country. Despite Uganda's extension and rural advisory services actively participating in climate-smart agriculture initiatives, there is a pronounced need for capacity development at both individual and organisational levels, along with broader system-level institutional reforms (Turyasingura & Chavula, 2022). Historically, the deficiency of an efficient agricultural extension system in Uganda has hampered the development of unified local social systems, limiting their ability to confront climate-related agricultural challenges and adopt practices like climate-smart agriculture (Raile et al., 2021).

By implementing robust and efficient extension service system, Ugandan farmers could enhance their climate resilience and mitigate climate-related agricultural challenges such as post-harvest concerns, disorganisation, skill deficiencies, and limited adoption of climate-friendly innovations. In the subsequent sections, this chapter presents empirical case study findings for Gulu, in Uganda.

6.5 Empirical findings for Gulu (Case 2)

By focusing on the extension officer occupation, this study examines the adequacy of an occupation as a mediating unit of intervention for climate resilience skills planning and development and whether it needs to be re-imagined.

This segment of the chapter addresses study objectives 3 and 4. These objectives involve examining how VET preparation for extension work takes place in response to climate resilience (objective 3) and evaluating the extension and VET policy and labour market's responsiveness to climate resilience responsiveness to climate resilience (objective 4). Section 6.6 and subsequent sub-sections (6.6.1 to 6.6.4) provide empirical insights into VET preparation for extension work. This is achieved by analysing the curriculum document and the Climate Resilience Assessment Tool and conducting interviews with extension officers who offered valuable perspectives on their experience and work-related activities concerning climate change, and offers insight into mediating institutions, tools in the SEM for skills. Sections 6.7 and subsequent sections (6.7.1 to 6.7.3) consider labour market information, occupational classification frameworks, and VET and extension policies, offering insights into the verticalities in the SEM for skills. Farmers were also interviewed and observations on farms were conducted to obtain insights into the horizontalities.

6.5.1 Case introduction

Gulu district, encompassing the city of Gulu and its surrounding areas, earned its city status in 2020. In the 2014 census, it had a population of 275 613, with 150 306 residents within the city's boundaries (UBOS, 2016). Gulu's history is scarred by a two-decade-long civil war (1986-2006) between the Lord's Resistance Army rebels and the Ugandan government, which severely hampered the region's development, particularly education, and disrupted daily life (Branch, 2013). The government responded to the unrest with a forced encampment policy, leading to the mass displacement of Gulu's residents (Slotkin, 2017). When the war subsided, many Internally Displaced Persons (IDPs) returning home found their customary-tenured lands either grabbed or privatised as boundaries became indistinct over the years (Veit, 2017). This situation was further complicated when the government allowed investors to acquire lands in the name of development under the Peace, Recovery, and Development Plan (PRDP). This plan, a collaboration between the Ugandan government and the UNHCR, allocated US\$ 600 million for initiatives like agriculture and infrastructure but indirectly paved the way for more land seizures, making land reclamation even harder for IDPs (United Nations Development Programme, 2015). As a result, smallholder agriculture's growth in Gulu faces significant hurdles.

Agriculture remains crucial in Uganda, particularly in predominantly rural districts like Gulu. Approximately 72% of Gulu's population actively engages in agricultural activities, encompassing crop production, livestock rearing, and forestry (UBOS, 2017). In the aftermath of regional conflict, agriculture in Gulu has emerged as a social and economic development tool, providing essential employment, generating household income, and ensuring food security. As aid from initiatives such as the PRDP wanes, the potential of agriculture looks brighter, highlighted by Gulu's achievement as the third-largest producer of sweet potatoes in Uganda in 2019, producing 61 732 tonnes annually (UBOS, 2020).

Understanding the centrality of agriculture, the Ugandan government, including local structures in Gulu, has heavily invested in agricultural extension services. These services play a significant role in the ongoing enhancement of farming practices, ensuring farmers receive timely and relevant farming knowledge and tools. The 2016 National Agricultural Extension Strategy (NAES) embodies this commitment. Developed to strengthen the effectiveness of pluralistic extension service delivery, the NAES strives to empower farmers, especially

vulnerable groups like women and youth (MAAIF, 2016). With a considerable budget allocation of 888 billion shillings (equivalent to US\$ 237.57 million) for five years, the strategy promotes synergy between governmental bodies and non-state actors such as NGOs. However, while such initiatives are commendable, challenges continue to cast shadows on Uganda's agricultural sector. The extension services have been periodically marred by inefficiencies, notably outdated methodologies like the Demonstration Effect and the NAADS system. Additionally, contemporary threats, like the increasing threats from climate change, compound these challenges. Proactive steps, including national policy directives on extension service delivery, offer mitigation strategies for some of these pressing issues.

In Gulu, the agricultural sector grapples with a unique set of challenges. Extension services, vital in enhancing farming practices, face hurdles such as land disputes and weak institutional support at the national and local government levels. These services have, unfortunately, been politicised, often sidelining farmers who lack influential social connections or capital (Löwe & Phiona, 2017; Mugonola & Baliddawa, 2014). Despite making up a significant portion of the farmer population in Gulu, as in other Ugandan regions, women find themselves at a disadvantage. Customary land ownership and traditions impede their land rights (Hopwood, 2015), constricting their agricultural engagement and access to extension services. Furthermore, many remain unaware of their rights under the Ugandan Land Act and the revised National Land Policy, which grants women ownership and decision-making capacities concerning land.

Nevertheless, agriculture holds the promise to propel Gulu's socio-economic growth. This potential can be unlocked by adequately facilitating extension services, raising awareness among women about their land rights, and equipping farmers with sustainable farming techniques. However, looming challenges like climate change, exacerbated by extensive deforestation, threaten Gulu's agricultural aspirations (Lotz-Sisitka & McGrath, 2023). This deforestation contributes to land degradation and intensifies climate-related impacts, with Gulu witnessing frequent droughts and floods. In 2019, the district recorded Uganda's highest average temperature at 32.1°C (UBOS, 2020). To combat these emerging threats, extension and advisory services are critical. They equip farmers with the tools to foster climate resilience, and in this situation, the anchor is having dedicated and competent extension officers.

The efficacy and preparedness of extension officers are intertwined with their formal training. In reviewing this aspect, I analysed the curriculum for the Bachelor of Science in Agriculture

program at Gulu University. This curriculum plays a vital role in shaping the education and skills of future extension officers. I aimed to assess the integration of climate change topics into this study curriculum. Leveraging the Curriculum Resilience Assessment Tool (refer to Appendix 1), I engaged both students and staff in assessing the curriculum's alignment with climate resilience concepts.

Gulu University is the leading post-school institution in Northern Uganda, established in 2003 through legislative action, with a mission to usher in transformative changes in the local community. The university's community-orientated values align with its renowned agricultural training programs (Gulu University, 2017). The Bachelor of Science in Agriculture degree, which serves as the primary course in training extension officers, boasts a curriculum that fosters a holistic appreciation of agricultural practices. These practices are centred on productivity and are situated in environmental conservation and sustainability. This rigorous programme has garnered accreditation from the National Council for Higher Education, underscoring its credibility and alignment with national education standards (Gulu University, n.d). Through interviews with academic staff and practising extension officers, I developed deeper insight into perceptions about the curriculum's capability to foster climate-resilient skills and competencies. The following section presents empirical findings from the Gulu case study.

6.6 VET preparation for extension work concerning climate resilience

This section presents findings pertaining to the third study objective, outlined in Chapter 1, section 1.3 of this thesis, which investigates how VET prepares for extension work concerning climate change in Gulu. A detailed analysis of the curriculum for the Bachelor of Science in Agriculture (BSc. Agric) at Gulu University is provided in section 6.6.1 below.

6.6.1 Examination of the curriculum documents

In this section, the primary objective was to review the course curriculum to determine how it is incorporating climate change elements to ensure that extension officers are well-equipped with skills in climate resilience. This review involved scrutinising the curriculum's structure, specifically the course outline comprising 54 course units, not counting recess term projects. This review focused on pinpointing course units that integrate climate-related topics into the study content, as highlighted in Table 6.1. The subsequent sections, from 6.6.1 to 6.6.3,

elaborate findings related to the curriculum's adaptability to climate challenges, insights from participants regarding the curriculum's structure and relevance, and explore the experiences and tasks undertaken by extension officers in their daily roles.

Table 6.1. Curriculum course content pertaining to climate change-related topics

Course units	Topic
Agricultural zoology	<ul style="list-style-type: none"> ● Influence of tropical vs temperate environmental conditions on animal production
Agroecology and biodiversity conservation	<ul style="list-style-type: none"> ● Renewable resources; non-renewable resources ● How non-renewable resources can be used sustainably; how renewable resources can become non-renewable ● The integration of conservation and development; sustainable management of natural resources; eco-region approach to managing resources ● Protected area categories in Uganda; ecotourism
Agriculture and environmental management	<ul style="list-style-type: none"> ● Threats to environment and natural resource management; extent of environment and natural resource degradation and implications ● Impact of agriculture on ecological systems ● Hydrological impacts of agriculture ● Impact of agriculture on individual plant and animal species ● Principles and concepts of sustainable agriculture; agroforestry; organic farming; multiple cropping systems; integrated systems
Farmsteads planning and design	Climate and environmental control
Soil and water conservation	<ul style="list-style-type: none"> ● Impact of soil and water degradation on human livelihoods; soil and water conservation ● Principles and practices of soil and water conservation ● Soil and water degradation management ● Policies for soil and water conservation in Uganda ● Water harvesting ● Irrigation and associated salinisation
Community field attachment	<ul style="list-style-type: none"> ● Field demonstration of setting contours for soil and water conservation structures using an A-frame ● Advising farmers on soil mapping, testing and conservation practices
Land use planning and Land evaluation	Climate and hydrology
Food security and community nutrition	Water and sanitation
Horticulture and landscaping	<ul style="list-style-type: none"> ● Garden seasons and climates and plant hardiness ● Importance of flow control to irrigation water management
Principles and practices of irrigation	<ul style="list-style-type: none"> ● Agro-meteorological measurements ● Weather synoptic and forecasting ● meteorology and climatology as related to agriculture, atmosphere and earth energy budget ● Aerial and soil micro-climate ● Irrigation water management irrigation delivery systems design, management and evaluation

Source: Author

As illustrated in Table 6.1, the Bachelor of Science in Agriculture curriculum encompasses 54 course units. Of these, 10 units, or 19% of the total, were identified to incorporate aspects related to climate change. This suggests an adequate integration of climate resilience topics

within the curriculum. Furthermore, the delivery approach for this curriculum predominantly employs lectures, demonstrations, and hands-on experiences both in laboratories and in the field. To gauge the proficiency and understanding of the students, the curriculum employs a combination of tests, practical exercises, and written examinations.

6.6.2 Analysis of Climate Resilience Assessment Tool

I utilised the Climate Resilience Assessment Tool to further the review of the curriculum's responsiveness to climate resilience, detailed in Appendix 1. This was undertaken with a carefully selected focus group consisting of three lecturers, the head of the department (HoD), and six final-year extension students. Their task was to review the curriculum using the tool, which was organised into four significant sections: curriculum content and topics, teaching approach of the programme, research and innovation, and community engagement as described in Chapter 4, section 4.5.3. For an effective review process, I tabulated the scores from each completed tool and consolidated these findings into an Excel sheet. This scoring process's specific criteria and methodology can be revisited in Chapter 4, section 4.5.3, and in Table 4.5 and Table 4.6.

In Figure 6.1, the data extracted, from the Excel spreadsheet (see Appendices B1 to B3 and C) shows the climate responsiveness of the Bachelor of Science in Agriculture programme at Gulu University. Through this graphical representation, the curriculum's alignment with climate resilience criteria can be observed.

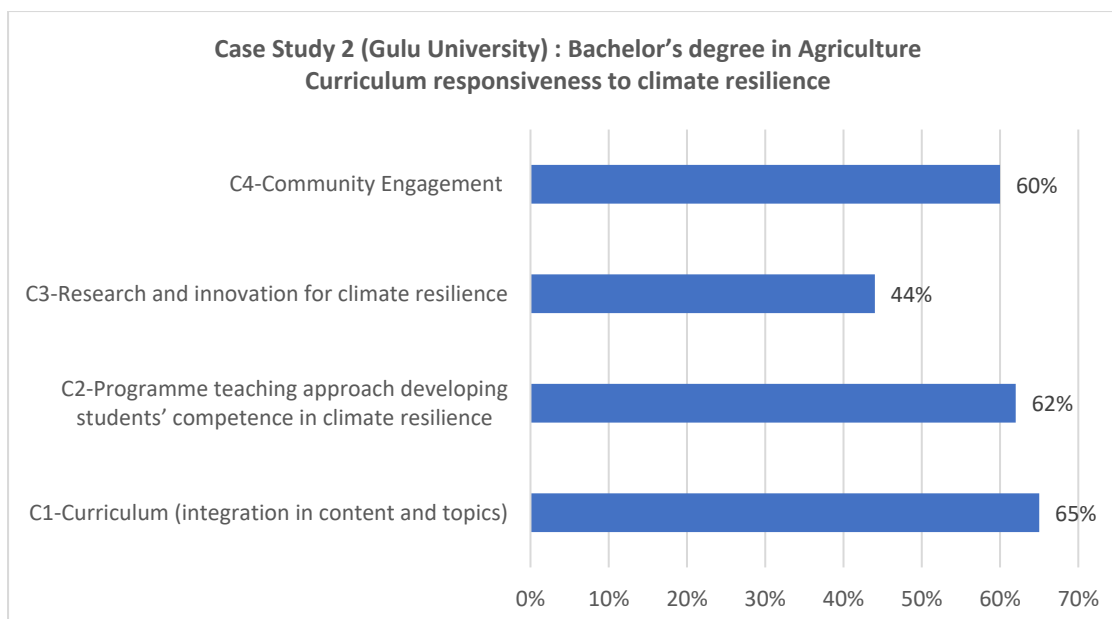


Figure 6.1: Climate Resilience Assessment Tool analysis for Bachelor of Science in Agriculture (Gulu University).

The Climate Resilience Assessment Tool's four sections (see Appendix A) produced varied results regarding their responsiveness to climate resilience. A summarised performance overview is as follows:

Section C1 – Study Curriculum Content. This section assessed the curriculum's ability to integrate topics related to climate resilience. With a score of 65% responsiveness, it showcases adequate climate resilience integration. Most topics, including renewable energy (Indicator A3), agroecology (Indicator A4), climate-smart agriculture, water management (Indicator A2), and greenhouse emissions, scored above 60%. This indicates robust coverage in the curriculum, excluding the climate resilience infrastructure (Indicator A6) as can be observed in Appendix B).

Section C2 – Teaching Approach reviewed the curriculum's teaching strategies for fostering climate resilience skills; it acquired a score of 62%. This suggests that the curriculum aptly equips extension students with climate resilience competencies. Notably, Indicator B5, which assessed the curriculum's efficacy in promoting adaptive management and facilitating social innovations for new climate resilience practices, scored the highest at 3.4 (see Appendix C).

Section C4 – Community Engagement: ranking third, this section analysed the curriculum's effectiveness in offering practical climate resilience skills through community involvement. It achieved a score of 60%, denoting satisfactory climate resilience engagement. Indicator E2, which assessed the of commitment of the department to allocate resources to climate change

mitigation and adaptation agricultural projects in the community stood out with a score of 3.6 as shown in Appendix C), highlighting the department's dedication to community-based climate adaptation and mitigation initiatives.

Section C3 – Research and Innovation. Focused on reviewing the curriculum's role in bolstering climate resilience through innovation and research, it attained a score of 44%. Although this indicates some achievement in climate resilience, there is room for improvement. The highest scoring indicator was D3, which assessed whether the Faculty of Agriculture and Environment collaborates with other departmental units and research organisations to research and innovate solutions for climate resilience, scoring 3.5 (see Appendix C). The Inadequacies in Research and Innovation within the department are exemplified by Indicators D6 and D5. Indicator D6 measured the level of financial support in form of bursaries available to students for researching and developing climate-smart agricultural innovations, scoring an average of 0.4 out of 5. Additionally, Indicator D5 which assessed the extent to which students and staff are encouraged to conduct research related to climate mitigation and adaptation topics scored 2.1.

6.6.3 Curriculum responsiveness as represented in interviews

To deepen the interpretation of the Climate Resilience Assessment Tool scores, I interviewed the extension staff who had completed an analysis using the tool to gain their views on the curriculum. Additionally, I spoke with extension officers who either graduated from Gulu University or were familiar with its curriculum, aiming to understand its adequacy in addressing climate resilience. The findings from these interviews were categorised into three overarching themes: curriculum review and update, the content of the curriculum study content, and the methods of curriculum delivery.

6.6.3.1 Reviewing and updating of the curriculum

Gulu University conducts a curriculum review for its Bachelor of Science in Agriculture every five years. The head of the department and lecturers confirmed through interviews that to stay relevant to current trends and emerging issues in the agricultural landscape, Gulu has committed to this periodic review approach. Guided by the National Council for Higher Education (NCHE) standards and guidelines, the university is also allowed to make interim adjustments as required during the five years. This ensures that any necessary changes or updates can be smoothly incorporated into the curriculum during the formal review. As

articulated by the Head of Department and other lecturers, the procedure is both rigorous and responsive, ensuring that the curriculum remains both up to date and comprehensive.

Every five years, we do a review of the curriculum. However, we don't have to wait for these five years. Because the guidelines permit us to make an adjustment within 30% of the curriculum over that five-year period, if there are some changes, which have to be done to the curriculum, we can do some minor reviews during implementation. But every five years, we do a major review and submit the documents to the National Council for Higher Education for accreditation. (UG-L3)

Of course, we are updating the curriculum with the new things, and even these things... originally we teach only extension and training methods but now we are even teaching innovation systems, because we know that we are no longer going just to teach extension and training methods. But you must also train them how farmers operate under some kind of innovation system, how do farmers innovate and co-innovate alongside extension workers. So, the curriculum is changing, in line with changing circumstances. (UG-L2)

In addition, the lecturers highlighted that Gulu University's standard five-year curriculum review process follows a structured and phased approach. It starts with an internal review carried out by the extension staff and their colleagues within the faculty. This initial phase is then succeeded by broader consultative meetings that engage various stakeholders, providing an inclusive perspective on potential updates, as lecturers elaborated.

First of all, it [curriculum review] begins as an internal process. It's an internal initiative where teaching staff will give input into the curriculum. Then we normally invite stakeholders as part of the curriculum review. NGOs, companies, local governments, farmers themselves, smallholders, and commercial farmers all come here, and we brainstorm on what content the outside world needs, facing the current circumstances. (UG-L2)

The [curriculum review] initiation stage is normally taken by lecturers who are specialists in those areas, but when we are doing review, we normally have consultative meetings with the different stakeholders. We have meetings with the students who have

passed through the programme, we have meetings with the lecturers who have taught the course, we have meetings with administrators, we have meetings with the industry we expect will employ the students to find out what they want, what skills do they want from students. So when we are reviewing we are able to make our course able to produce the graduates who have the skills, both the soft and hard skills. (UG-L1)

Moreover, during the interviews with lecturers, it was brought to light that such adaptability in the curriculum empowers Gulu University to swiftly respond to changes in the agricultural sector, particularly in areas related to climate change, as articulated by lecturer UG-L2: “We change the curriculum in line with changing circumstances. Even climate change is well catered for in all our programmes, including this programme. We want our training methods to support farmers co-innovate for climate change alongside extension workers.”

The interviews with lecturers also revealed that the university executed a five-year review process, resulting in modifications to the programme after a span of three to four years and alterations in the curriculum content. Lecturers mentioned that a driving factor for the periodic review and subsequent updates, including the extension of the degree programme’s timeline, was the voluminous content that posed challenges for students to grasp within the initial three-year timeframe, as highlighted by UG-L1: “The old curriculum I underwent when I attended the same course for three years was massive. It was too big, and we got exhausted covering it in three years. So, it was reviewed and had to be changed to four years.”

The detailed results above highlight Gulu University’s methodical approach to reviewing and updating its Bachelor of Science in Agriculture curriculum every five years. This ensures it remains relevant by incorporating issues such as climate change concerns as they emerge. Additionally, the flexibility embedded within the National Council for Higher Education’s guidelines empowers Gulu University’s internal team to introduce provisional modifications. These changes are then fully integrated and refined during the comprehensive five-year review, where a broader range of stakeholders provide their insights to enrich the curriculum further.

6.6.3.2 Curriculum study content

The Head of the Department emphasised the university’s commitment to aligning its curriculum content with existing international and national policies. He highlighted the

importance of ensuring that the priorities within these policies are integrated into both curriculum content and instructional resources. For clarity, he pointed out that the current incremental reviews being undertaken in the curriculum incorporate benchmarks against global standards, including the Sustainable Development Goals (SDGs), the African Union Agenda 2063, and the National Development Plan of Uganda. He elaborated as follows:

When we are developing all the curriculum material in our course, we look at the ... we start from the global development agenda, the SDGs, we come to the regional African level with the Agenda 2063, then we come to the National Development Agenda, like right now, we talk of NDP III. (UG-L3)

Lecturers at Gulu University underscored the significance of climate resilience in their curriculum. Many emphasised that the curriculum has extensively incorporated climate change topics, with UG-L2 highlighting its richness and its coverage of subjects like pollution and climate change: “It is a very rich curriculum. Even it has elements to do with solid and water pollution, things to do with climate change, and very many other things”. Notably, climate change stands out as a focal topic that the extension lecturers are deeply passionate about. One particular lecturer, UG-L3, highlighted the curriculum’s responsiveness to pressing issues, including gender disparities, which are said to be prevalent in Gulu. Lecturers believe that it is paramount for the curriculum to integrate gender issues since climate issues disproportionately affect women farmers, as detailed in context section 6.6.1, so that students are adequately prepared to address them in their professional work. The lecturer noted the curriculum’s adaptability: “Emerging issues, such as gender and climate concerns, are consistently integrated during curriculum development workshops”.

An extension officer who graduated from Gulu University echoed the sentiments of the lecturers regarding the inclusion of climate change topics in the curriculum. Although unable to narrate all specific topics, this extension officer confirmed the curriculum’s coverage of subjects related to natural resources, waste management, and sustainable farming practices, affirming the university’s commitment to integrating climate change themes. UG-EO4 said, “... there was a course unit on agrometeorology, and then there was also agro-climatology in agriculture in relation to climate. Those courses were there.”

The findings in this section revealed that Gulu University is proactive in updating its curriculum to integrate pertinent issues, mainly climate change. Drawing inspiration from international, regional, and national policy directives, the university ensures that its curriculum remains relevant and aligns with overarching priorities, thereby equipping extension officers with the knowledge and skills relevant to their occupation in the context of current challenges.

6.6.3.3 Methods of curriculum delivery

Lecturer interviews shed light on the fact that the Bachelor of Science in Agriculture curriculum at Gulu University combines theoretical knowledge with hands-on experiences. As highlighted in the curriculum analysis in section 6.6.1 and Table 6.1, students are not confined to the classroom; they are immersed in field-based practical sessions using diverse teaching approaches. The use of blended methods in teaching extension students at Gulu University was also affirmed by lecturers during interviews as one lecturer noted:

We involve them [students] in study trips, invite some guest lectures, in some cases. As I said previously, we have been using a lot of more teacher-centered approaches. But we have, I think we are among the few universities around the country, who have transitioned to a more of a student-centered approach. (UG-L3)

A unique aspect of their training is through field attachments which involves engaging directly with local farmer communities. This student-farmer attachment model offers students invaluable insights into indigenous agricultural practices and hones their communication skills, which are integral for extension officers. Lecturer UG-L2 emphasised that such attachments prepare students for their future roles, ensuring they are confident in their interactions with farmers. According to him, the aim is to ensure that “when students leave Gulu University after their degree, they are not nervous about meeting and working with the farmers”. Notably, these direct interactions with farmers equip students with practical skills in climate resilience, as other lecturers remarked:

We integrated the farmer attachment model to make our course able to produce extension graduates with soft and hard skills in sustainable agriculture. So that is what we do at Gulu University. We want to produce graduates that serve farmers all over the country, even in areas with varied climatic conditions and challenges. (UG-L1).

We try to integrate our students among those farmers, so we actually attach the students to these farmers so that when they are skills under training, they can also learn and

understand the context of the farmer... we have lectures and do practical when we involve them [students] in field attachment. That is a bit of community engagement.
(UG-L3)

In addition, the lecturers highlighted that the shifting agricultural landscape due to climate change has necessitated a proactive response from the university. As a solution, students are motivated to collaborate directly with farmers, fostering co-innovation to enhance the climate resilience of the communities they serve.

Currently, farmers have the challenge that the climate has been changing. There are now a lot more pests than before, farmers get losses from drought because it is not raining regularly, and at times their crops are affected by hailstorm. So basically, the hazards related to climate, I think, have increased in the last ... maybe in the last 20 years. (UG-L3).

Additionally, lecturers pointed out the government's drive to support the transition of smallholder farmers to commercial farmers. Given the pressing climate change concerns, the curriculum's implementation aligns with policy guidelines, emphasising the agribusiness component. This is mainly executed through the student-farmer attachment, where students collaborate with farmers to cultivate climate-resilient and sustainable agricultural practices, as expressed by UG-L1:

... then another way we're using to teach them [extension students] is also through business development. If they can identify a problem from the community, come and find a solution to it, make the solution a business, like a social business which is sustainable and resilient to climate.

Lecturer interviews revealed a prevailing concern about the relevancy of the extension officer role if these professionals are not adept at aiding farmers facing the rising challenges of climate change. By incorporating practicals into the curriculum, they hope to ensure the programme produces extension officers knowledgeable about climate change and skilled in fostering climate resilience. This notion was corroborated through curriculum analysis, illustrating that students cover subjects like soil and water conservation during their field attachments. Here, they partake in hands-on activities such as establishing soil and water preservation contours and guiding farmers on soil mapping, testing, and conservation methods (refer to Table 6.1). This sentiment was summarised by a lecturer who remarked:

I think it's important that students do more research and hands-on practice with farmers in areas of trending issues, for instance, climate change. I've even recently heard about climate financing, which is going on a lot, and extension officers need to be on top of all that and many other emerging issues. (UG-L1)

The curriculum for extension officers at Gulu University has been flagged for certain shortcomings. Notably, from the insights gathered from interviews with extension officers and lecturers, a gap lies in the packaging and communication of information related to climate extension. While the curriculum does encompass climate change as an independent course, it is yet to fully integrate its complexities effectively into the extension component. It was said that the curriculum does not adequately equip students with the requisite skills to convey climate information to farmers effectively. As remarked by UG-L1, “While students are introduced to climate change aspects, they are not adequately trained in tailoring and delivering these messages appropriately to the farming community”.

The crucial role of communication in extension delivery cannot be understated. From the insights provided by lecturers, there is a gap in the current curriculum where students are not as yet equipped adequately to discern, tailor, and communicate critical climate change information to its primary recipients, the smallholder farmers. This points to the need to give more attention to infusing competencies that emphasise the packaging and conveying of climate-related information effectively to the farming community.

In summary, findings in this section have shown that the curriculum at Gulu University integrates climate resilience as a core element of extension services, aligning its content and curriculum implementation approaches to meet the community's unique needs. The university's distinctive student-farmer attachment model serves as proof of this commitment, offering students an invaluable hands-on experience to acquire and hone practical climate-related skills vital for their future roles. However, a notable area for development is the curriculum's limited focus on climate communication, emphasising the need for refining how climate information is packaged and conveyed to the farming community.

6.6.4 Experiences and work-related activities of extension actors

As outlined in Chapter 1, section 1.3, another component of the third objective of this study was to review the lived experiences and associated work activities of those involved in

extension services. Drawing from the data gathered during interviews with farmers, extension officers, and lecturers from Gulu, this section provides the findings on the depth of participants' knowledge of climate change and their climate resilience competencies and skills.

During interviews, extension officers demonstrated a perceptive grasp of climate change, its associated risks, and its impacts on farmers and the occupation. They detailed numerous challenges encountered while assisting smallholders in adapting to and mitigating the impacts of climate change. These challenges encompassed altered planting seasons resulting from inconsistent rainfall patterns, extended drought periods, regular outbreaks of pests and diseases, and flooding. Extension officers provided a comprehensive overview of the climate-related issues they confront alongside smallholder farmers. Challenges such as pests and diseases, changing planting seasons due to inconsistent rainfall, prolonged droughts, and flooding were common concerns shared by both farmers and extension officers in Gulu. Some of the extension officers remarked that:

There's rampant cutting down of trees, and that's why we have experienced over time, sometimes this area has never been known for floods. And another thing, people have been cutting down trees over the years. We know they have to look for a source of livelihood, but you realise that over time, the climate of the place has changed drastically. Like last year, we had excessive rainfall, and other areas had serious floods. And crops were destroyed, even livestock, which used not to happen. I believe that this resulted from the deforestation that people are doing. (UG-EO3)

It used to rain maybe in March, but it can delay; it may rain in May. So, due to the activities, we have caused ourselves, if we look at the production, we are getting these days, it is not like it used to be in previous days. Even if we ask farmers, they also don't know what has happened. Because people are cutting down trees, people have reclaimed the swamps, very many activities that have taken place like industrialisation, the fumes, you've seen, all those are all causes of climate change. (UG-EO6)

Looking at the changes in the climate and all that, everything is so unpredictable because farmers of Uganda, like we are, like 90% depend on the nature, and the nature is not like what like fathers or grandfathers used to have. They could predict that around the 15th of March that there will be the first rain. But now February you find its raining or, it is even starting to rain in April. It is really unpredictable. (UG-EO5)

According to their comments, extension officers' observations suggest that human activities, particularly deforestation, are exacerbating the impacts of climate change in the area. This allusion emphasises the interconnectedness of environmental degradation and its amplifying effects on climate-related challenges.

The interviews shed light on the disparities in professional development opportunities between extension officers employed by the government and those working for non-state entities like NGOs or international development organisations working in agriculture with smallholder farmers. Government-employed officers often feel under-resourced and out of touch with recent advancements due to limited training opportunities. For instance, UG-EO3 remarked that.

Most of the NGOs are really promoting climate smart agriculture, to the farmers that they work with. And they have training workshops for their officers [Extension] here and there. I would really need a deeper learning to have a little bit of knowledge of Climate smart agriculture because even me sometimes I tell them [superiors at the Department of Agriculture] that I would need that training.

In contrast, their counterparts in non-governmental roles benefit from periodic capacity-building sessions, which keep them updated on climate resilience techniques and innovations for supporting farmers as UG-EO5 noted: “We get training from [employer].... In the short training that I have especially on the participatory enterprise development, part of that training, it [climate-expertise] was integrated, like climate smart agriculture was part of it”.

This distinction highlights the importance of continuous professional development, especially in fields impacted by rapidly changing environments such as climate change.

The extension officers from NGOs and private sectors recognise the effort made by their employing organisations in promoting climate-smart agriculture. However, UG-EO5 highlighted a common concern regarding the efficacy of these capacity-building sessions. Though such initiatives are commendable, their sporadic nature and short duration limit the depth and retention of the knowledge imparted. This feedback underscores the need for more comprehensive and sustained training to ensure that extension officers can fully grasp and implement climate-smart practices effectively.

Public extension officers exhibited a strong interest in enhancing their knowledge and skills in climate resilience. However, they voiced concerns about the lack of backing from the

Directorate of Extension Services in this aspect. Moreover, these officers pointed out an evident gap in communication between them and higher-ranking officials. Such limited dialogue has hindered the exchange of insights, identification of knowledge gaps, skill necessities, and comprehension of the overarching challenges linked to climate change that require attention to effectively support farmers. As one public extension officer distressingly remarked:

Looking at the trending challenges in agriculture, like climate change-related issues, we need to have full package information about it so that when we're interacting with our higher authorities, we can advise in relation to the weather and climate in our area and request the technologies that do well in the locality. Also, in relation to that climate-specific area, it should be focused on weather forecast information. (UG-EO6)

Extension officers identified essential areas of expertise in climate resilience that would bolster their efficiency in their roles. Notably, they emphasised the significance of mastering rainwater harvesting and soil moisture conservation methods. These techniques would be instrumental in assisting farmers to navigate the recurrent and extended drought periods prevalent in rural areas of Gulu. The following are some of their remarks regarding the recurrent challenges of climate change.

Right now, the climate has started changing. Sometimes you find that it rains for a few months, and then it stops. Then sometimes, it also takes several months without even stopping. So, you must prepare yourself. Like if rain is meant to stop, then how do you manage the little water or the little rain? Maybe the water harvesting, Maybe like, how do you preserve moisture in such a way that it is enough for the plant to utilise it until it matures. (UG-EO4)

I also need some more training on climate-related issues because we are always experiencing climate effects, which almost all the time affect our farmers, including me, who is practising agriculture. So, I feel I should get more training on that... (UG-EO2)

Extension workers need to learn about climate change because it is real and has impacted the farmers seriously. So, they need that knowledge to make farmers integrate it into their activities. Such that the environment can remain protected as well as farmers at least they can improve on what they are harvesting ... animals must be there, crops must be there, and trees must be there. So that we have a symbiotic relationship. (UG-EO1)

The above remarks from extension officers highlight their awareness of the threats climate change poses to their extension work and farmers' livelihoods. However, their opportunities for skill-building in climate resilience are scant. The officers recognise the farmers' challenges, especially with droughts, and the urgent need for knowledge in climate-smart farming practices. Despite this, the extension officers themselves are handicapped by a lack of these essential skills. Their responses indicate that while climate resilience is an imperative aspect of their role, there has not been adequate emphasis on equipping them with the necessary competencies in this area. The subsequent section details the findings pertinent to the fourth study objective, which covers the responsiveness of policy and labour market information regarding climate resilience.

6.7 Labour market and policy analysis

In addressing the fourth objective of the study—reviewing agricultural extension and VET policy and labour market data for its responsiveness to climate resilience (as stated in Chapter 1, section 1.3), this section presents findings from examining labour market information sourced from secondary documents. Central to this analysis is the extension officer occupation, and this section analyses critical aspects, mainly entry requirements, main qualifications, requisite skills, experience, core knowledge and primary tasks and roles. The review of labour market information further extends to the analysis of occupational classification frameworks, assessing if these structures are responsive to climate resilience and integrate it as a major concern or not. Finally, an analysis of extension and VET policy is presented to reveal how climate change is mainstreamed.

6.7.1 Labour market analysis

To gain insight into the occupational criteria for recruiting extension officers in the labour market, I scrutinised eight online job postings by both public and private entities offering extension services. From these, three job advertisements were selected as representative, encompassing the majority of commonly stated requirements found across all the listings. In addition, I reviewed the extension guidelines set by the Ministry of Agriculture, Animal Industry and Forestry. In the second segment I analysed the 2008 International Standard Classification of Occupations (ISCO-08) as detailed in Chapter 4, section 4.6, Table 4.5. This section on labour market information analysis aimed to identify the core knowledge, requisite skills and competencies, qualifications, and the expected tasks or roles of extension officers. A synthesis of the labour market analysis for the extension officer occupation is provided in Table 6.2.

Table 6.2. Extension officer occupation requirements and tasks for prospective extension officer

Job advert 1 Agriculture Extension Officer	Job advert 2 Agriculture Extension and Outreach Advisor	Job advert 3 Agronomy Officer	MAAIF Agricultural Extension Guidelines and Standards (2019)	Summary of core requirements
Minimum entry Qualifications (NQF)				
Bachelor's degree in agriculture, agriculture extension, agribusiness, agricultural land use and management or related field from a recognised institution	Masters level or higher degree in agricultural extension, agribusiness or related field	A minimum of a diploma in agriculture or related studies, a degree is preferred	A degree from accredited institutions (at bachelors, masters, or PhD level) in agricultural disciplines, environment, forestry, fisheries, food science and nutrition, land management, and other relevant areas A para-professional – a certificate or diploma in the above-mentioned areas	Agriculture or related studies (non-state actors) and Bachelor's degree for government extension
Duties/Tasks				
<p>(a) Mobilise farmers into groups for the delivery of Extension services.</p> <p>(b) Identify farmers' needs and respond as appropriate.</p> <p>(c) Assist farmers and their leaders (unit and block) to identify suitable land and plan the schedules for the recommended services and farm inputs</p> <p>(d) Provide agricultural advisory and training service to palm oil farmers in collaboration with agricultural staff at the district local government and the private sector.</p>	<p>(a) Transferring, scaling and prioritising the village agent model as a model to improve the incomes of farmers, traders and village agents.</p> <p>(b) Promote and implement the model in districts countrywide, beyond just the scope of the established focus zones</p> <p>(c) Develop a budgeted plan for transferring, scaling and prioritising the village agent model.</p> <p>(d) Assist in the development of communication tools and policy briefs</p> <p>(e) Assist in developing monitoring and evaluation plans</p>	<p>(a) Participate in developing structures and systems to improve agricultural private sector-led extension services</p> <p>(b) Ensure farmers have access to weather information.</p> <p>(c) Collect, compile, verify, enter and keep data on the Apolou programme.</p> <p>(d) Ensure that programme activities apply gender equity and youth empowerment.</p> <p>(e) Prepare timely weekly, monthly and activity progress reports</p> <p>(f) Link farmers to access genuine agro-input implements from agro-input dealers, retailers, agents</p>	<p>(a) Mobilise and register farmers into production and marketing groups</p> <p>(b) Advise the farmers on the recommended pest and disease resistant varieties or breeds</p> <p>(c) Collect agricultural statistics</p> <p>(d) Provide regulatory services and agricultural planning</p> <p>(e) Conduct study tours to learn from other farmers</p> <p>(f) Train farmers in improved production</p>	<p>Training and mobilising farmers to deliver extension services.</p> <p>Providing farmers with weather information.</p> <p>Exposing farmers to best farming practices.</p> <p>Coordinating with other sector stakeholders like input dealers and traders.</p> <p>Carrying out demonstrations</p> <p>Researching and developing communication tools and policy briefs.</p>

(e) Carry out agronomic demonstrations, training or exposure of farmers to best oil palm agronomic practices. (f) Conduct in-field training sessions on the correct use and application of fertilisers and crop protection products.		(g) Conduct training following the extension curriculum and farmer field school in accordance with the guidelines.		Identify farmers needs and provide an appropriate response
Knowledge				
Knowledge of oil palm agronomy		Gender-sensitive agricultural extension services, agricultural marketing, knowledge of perma gardening/permaculture, farmer field school, monitoring and evaluation	Good understanding of community and social systems, possess appropriate technical knowledge of relevant subject matter, knowledge of conducting needs assessment, develop extension programmes	Knowledge of agricultural practices, agricultural marketing, gender-sensitive agricultural extension, understanding of the context
Skills and competencies				
Writing reports, financial management, planning	Strategic planning and programme management. Leadership and judgment problem-solving and analytical skills Organisational skills	Excellent English language communication (written and verbal) and fluency in Ng'akarimojong are required for Karenga, Swahili and/or Pokot for Amudat, reporting skills, stakeholder management and coordination	ICT skills, ability to conduct a training, good communication and facilitation skills, administrative skills, monitoring and evaluation, networking and partnership skills, conflict resolution skills	Excellent communication skills, financial management, planning, analytical skills, reporting skills, problem-solving

Source: Author

Table 6.2 summarises findings for Uganda's extension officer occupation's key entry requirements dictated by the labour market. There are four observations from the synthesis in Table 6.2 above.

Emphasis on academic qualifications: Employers prioritise academic qualifications as a primary criterion for hiring. This emphasis on formal educational achievements can sometimes overshadow the practical and core knowledge essential for the role. The distinction between junior and senior roles is based mainly on the level of academic qualifications rather than expertise or experience in the field, as seen in job adverts 2 and 3.

Core knowledge defined at task level: Employers seem to gauge the knowledge requirement of extension officers based on their expected tasks. This approach can sometimes mean that core knowledge required for effective functioning might be overlooked in favour of task-specific knowledge. The current occupational structuring for extension officer, as evidenced by the data, underscores a top-down approach where knowledge requirements are dictated by tasks, suggesting that employers' focus is on what tasks extension officers should perform and the associated knowledge they should possess. Interestingly, findings show that this core knowledge aligns more closely with broader task areas or workstreams (such as agricultural research, monitoring and evaluation, communication and marketing, and community liaison) rather than with formal academic qualifications. This reveals a hierarchical and potentially restrictive occupational structure that emphasises qualifications over practical expertise. Additionally, the skills required for these identified workstreams might not be unique to the extension officer occupation; they can overlap with other occupations like advertising specialists, market research analysts, and community development practitioners (identified in ISCO-08 based on role descriptions). Such integration of cross-occupational expertise can enrich the extension officer role, making it more adaptable and effective, especially in the face of the dynamic challenges in agriculture.

Lack of focus on climate resilience: There is a conspicuous absence of references to climate change, climate resilience, and sustainability in the job requirements. While VET and policy emphasise the importance of climate resilience, this priority does not seem to be reflected in the job market's demand for the extension officer occupation.

Agribusiness and enterprise development are significant aspects: A significant emphasis is placed on agribusiness and enterprise development in the job requirements. This focus contrasts

with the VET training for extension (section 6.6) and extension policy (see section 6.7.3), which highlight the importance of climate resilience. The job market's demand seems to be out of sync with the training and policy directives.

Overall, the findings indicate a potential gap between what the training institutions teach, the policy direction, and what the job market demands from extension officers. While there is a growing need to integrate climate resilience into the agriculture sector, it appears that the labour market has not fully acknowledged or integrated this requirement into its hiring practices. This misalignment could result in extension officers who are not adequately equipped to address the emerging challenges of climate change in their roles.

6.7.2 Analysis of Occupational Classification Framework

The second segment of labour market analysis was reviewing the ISCO-08's responsiveness to climate resilience. The ISCO-08 classification, as indicated in Table 6.3, provides a comprehensive framework that shows the variety of tasks and skills linked with the extension officer occupation and other related occupations. Uganda's adaptation of the ISCO-08, due to the absence of a locally developed occupational classification framework, underscores ISCO's flexibility and comprehensive nature. By mapping out how extension officer and related occupations are described and categorised and their associated tasks, this analysis offers invaluable insights into the multiple dimensions of these occupations. This kind of systematic breakdown is critical for stakeholders in Uganda's agricultural sector, as it aids in understanding the complexities of these roles, fostering informed decision-making in education, training, and employment within the sector.

Table 6.3. Occupations identified from the International Standard Classifications of Occupations (ISCO-08) related to extension occupation

ISCO-08 code	Occupation	Task description	Qualification, skills, and competencies
3142	Agricultural technician	Collecting and preparing specimens such as soil, plant and animal cells for experiments and analyses. Ensuring adherence to policies and regulations concerning environmental protection and resource utilisation	Not available
1311	Agriculture and forestry production managers	Monitoring market activity, and planning production to meet contract requirements and market demands, recording information such as farm and fisheries management, recording information such as farm and fisheries management	Not available
3359	Unclassified government regulatory associate professionals; agricultural inspector	Performing related investigative and administrative tasks to record findings, monitoring price regulation to assess the appropriateness of costs for goods and services	Not available

Source: Author

The ISCO-08 analysis unveils a significant gap in how Uganda adapted the international occupational framework to reflect its agricultural sector's unique and context-specific demands. Specifically, the Uganda Bureau of Statistics (UBOS) has shown discrepancies in how it tailors some occupations to the local context, particularly concerning the extension officer. As inferred from Table 8.3, while the extension officer occupation is not distinctly delineated, it resembles the responsibilities described under the agriculture and forestry production managers. However, a more fitting categorisation would position the extension officer into the agricultural Technician occupation, given the supportive roles of agricultural technicians, as highlighted in ISCO-08. However, strangely, the agricultural scientist's role is not explicitly defined within the framework.

Furthermore, the ISCO-08 does not adequately capture other fundamental aspects of the extension officer's role and requirements, including qualifications, skills, and competencies. The streams of work identified in Table 6.3 are policy analysis and implementation, marketing and monitoring and evaluation. Concerning the evolving demands of the agricultural sector,

the framework notably lacks any references to climate change or sustainability, which are pressing concerns in contemporary agriculture.

Comparatively, the labour market analysis presented in Table 6.2 offers more contextually relevant insight into the prerequisites for the extension officer role compared to the generalised ISCO-08 framework in Table 6.3. It is evident that the ISCO-08 does not include information on climate resilience mainly for the extension occupation and related occupations as per the descriptions.

6.7.3 Climate change in Uganda's policy on VET and extension

This section presents the findings in response to objective 4 of this study, as outlined in Chapter 1, section 1.3, reviewing agricultural extension, VET skills development policy, and labour market data for its responsiveness to climate resilience. This section presents an analysis of agriculture and climate Policies to establish if climate change is integrated and emphasised. To contextualise the findings, I present below a concise overview of climate change in Uganda's policy below. This is essential for understanding how policy may or may not be influencing integration of climate resilience aspects in extension education and work in Gulu. The four policies were selected based on their relevance to the agricultural sector and skills development (see Table 6.4). The analysis identified policy objectives or action plans on climate change and agriculture.

6.7.3.1 Climate change in Uganda's policy

The analysis of policy on extension and climate change in Table 6.4 sheds light on the policy responsiveness to climate change.

Table 6.4. Climate change and extension-related policy objectives or interventions

Policy	Policy references to extension/VET	Climate reference/ policy objectives
Uganda Vision 2040 (2013) ¹³	<p>The policy emphasises the need for the government to reform the extension system to increase information access, knowledge and technologies to the farmers and improve weather information and its dissemination.</p> <p>The policy identifies that agriculture productivity of most crops has been reducing partly due to poor production techniques and limited extension services.</p> <p>The policy highlights the government’s commitment to creation of incentives to increase the relevance of training and skills re-orientation. To achieve this the government plans to institute and support a national training programme students to train in leading Universities and other training institutions (p. 69)</p> <p>The Policy further indicates the willingness to develop and review study curricula and learning content periodically to align what students are taught and what industry requires (p.58)</p>	<p>The policy highlights that Uganda is experiences signs and effects of Climate Change that are manifested by changes in rainfall patterns, prolonged droughts and floods as well as higher temperatures which provides a fertile ground for pests and diseases.</p> <p>The policy indicates that Uganda’s agriculture is heavily dependent on rain fed agriculture and agricultural sector is affected by climate change impacts</p> <p>The policy mentions the need to intensify environmental control measures to halt the decline in soil fertility as a measure to improve agricultural production The government has limited attention to climate change mitigation and adaptation measures and advocates that the sectors and local Governments must plan to adapt to climate change while undertaking mitigation measures to prevent erosion of climate security and ensure sustainable food production.</p>
National Development Plan (NDP III) 2021-2025	<p>The agro-industrialisation policy component plans to:</p> <ul style="list-style-type: none"> (i) Operationalise the agricultural extension system (ii) Develop and operationalise an ICT-enabled agricultural extension supervision and traceability system (iii) Scale up innovative extension models such as nucleus farmers in all agroecological zones (iv) Incorporate BTVET institutions into the agricultural extension system to ensure that what is taught 	<p>Promote inclusive climate resilient and low emissions development at all levels by:</p> <ul style="list-style-type: none"> (i) Promoting continuous integration of climate change and disaster risk reduction in planning, budgeting and reporting (ii) Improving education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

¹³ The Uganda Vision 2040 is a National Development Framework developed in 2013 by the National Planning authority that to be achieved in 30 years and will be implemented in three phases of 10 years each. It can be accessed at <http://www.npa.go.ug/wp-content/uploads/2021/02/VISION-2040.pdf>

	<p>in these institutions is adopted and utilised by farmers</p> <p>(v) Develop and equip youth with knowledge, skills and facilities for access and utilisation of modern extension services</p>	
National Adaptation Plan for the Agricultural Sector (2018)	<p>The Policy has the following action objectives:</p> <p>(i) Promote climate-resilient cropping systems and value chains</p> <p>(ii) Build capacity of extension workers on irrigation and water management and aquaculture production technologies, dissemination of climate-smart agriculture technologies and practices</p> <p>(iii) Mainstream climate change into agricultural extension and community management</p> <p>(iv) Train and build the capacity of extension and community development workers to deliver climate-smart agricultural technologies and practices</p> <p>(v) Strengthen platforms through which small-scale farmers can access agricultural information and extension services</p>	<p>Policy focuses on building climate resilience in the agricultural sector through mitigation and adaptation measures. Some of the actions included in the policy are to:</p> <p>Identify suitable sites for rainwater harvesting and agricultural water management schemes.</p> <p>Train farmers/ household members in water harvesting and agricultural water management technologies.</p>
Uganda National Climate Change Policy (2015)	<p>Policy's main objective is to ensure a harmonised coordinated approach towards a climate-resilient and low-carbon development path for sustainable development in Uganda.</p>	<p>In the agricultural sector, the policy aims to promote climate change adaptation strategies that enhance resilient, productive and sustainable agricultural systems.</p> <p>In extension, the objective is to support community-based adaptation strategies through stretched extension services and improved systems for conveying timely climate information to rural populations to enhance the resilience of agricultural systems to the impacts of climate change.</p>
National Agricultural Extension Strategy (2027-2021)	<p>(i) To establish a well-coordinated, harmonised pluralistic agricultural extension delivery system for increased efficiency and effectiveness</p> <p>(ii) To empower farmers and other value chain actors (youth, women and other vulnerable groups) to effectively participate and benefit equitably from agricultural</p>	<p>(i) Reviewing, developing or identifying and packaging appropriate climate change adaptation technologies in collaboration with research organisations</p> <p>(ii) Disseminating vetted and tested climate change adaptation technologies</p> <p>(iii) Carrying out regular coordination meetings with non-state actors (NSAs,) and other agencies on environmental management issues.</p>

	extension processes and demand for services (iii) To develop a sustainable mechanism for packaging and disseminating appropriate technologies to all categories of farmers and other beneficiaries in the agricultural sector (iv) To build institutional capacity for effective delivery of agricultural extension services	(iv) Carrying out joint monitoring with NSAs, other agencies to harness and guide initiatives on climate change and environmental management issues (v) Conducting capacity building trainings for staff from NSAs through existing institutions and stakeholder platforms to harness and guide initiatives on climate change and environmental management issues
Technical Vocational Education and Training (TVET) Policy (2019)	The TVET policy has no reference to extension services or agriculture. It focuses on developing a labour market responsive TVET system.	No reference to climate change

Source: Author

The analysis from policies on climate and agriculture shows an explicit acknowledgment of the impact of climate change on Uganda’s agricultural sector and extension services system’s potential to provide adaptive capacities to farmers to navigate the climate-related challenges. For instance, the Uganda Vision 2040 (National Planning Authority, 2013) specifically highlights the adverse effects of climate change on the predominantly rain-fed agricultural sector in Uganda. This policy recommends intensifying climate adaptation and mitigation measures for sustainable food production. Suggestively, the Uganda Vision 2040 further underscores the necessity of reforming the agricultural extension system to enhance farmers’ access to climate information, knowledge, and crucial climate and weather information.

Furthermore, the National Adaptation Policy of Agricultural Sector (NAP-Ag), developed by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) in 2018, sheds light on the existing gaps in climate knowledge and adaptive skills among farmers and extension officers. Recognising the implications of these gaps on the agricultural sector, the policy emphasises the urgent need for capacity building for extension officers. The NAP-Ag policy specifically advocates for the training of extension workers in irrigation and water management technologies, aligning with the broader vision outlined in the National Agricultural Policy (MAAIF, 2013). This overarching policy framework, developed 5 years earlier, emphasises the proactive addressing of climate change threats to agricultural productivity and food security. In particular, the NAP policy underscores the imperative of building capacity at all levels to plan and implement activities aimed at addressing climate change and its impact on agriculture. This holistic approach signifies a concerted effort to equip extension officers with the necessary

knowledge and skills to guide and support initiatives related to irrigation, a crucial component of adaptive strategies in the face of a changing climate (MAAIF, 2013, p. 19; MAAIF, 2018, p. 51).

Uganda's National Adaptation Plan for Agricultural Sector (MAAIF, 2018) offers a strategic framework for enhancing the resilience of the country's agricultural sector in the face of climate change. The Plan outlines key objectives that encompass promoting climate-resilient cropping, livestock, and fisheries systems. It also emphasises the importance of disseminating timely climate information to facilitate informed agricultural decision-making. The plan further advocates for sustainable natural resource management, highlights climate-smart agricultural research and innovation, encourages knowledge-sharing and partnerships to reduce sector vulnerability, and places a significant focus on gender-sensitive programs to address the specific vulnerabilities faced by women, youth, and other marginalised groups within the context of climate change. This holistic approach positions agriculture as a key driver of sustainable development in Uganda amidst the challenges posed by a changing climate.

In alignment with this National Agricultural Plan for Agricultural Sector (MAAIF, 2013), the National Agricultural Extension Services Strategy (MAAIF, 2016) serves as a fundamental mechanism to translate the outlined objectives into actionable initiatives. Strategy 3.1.8 within this framework is dedicated explicitly to addressing the challenges posed by climate change. This strategy underscores the need for collaborative efforts between the Ministry, other governmental agencies, and non-state actors to create, package, and disseminate climate change adaptation and mitigation technologies. The aim is to strengthen the resilience and sustainability of cropping, fisheries, and animal systems (MAAIF, 2016a). While the strategy emphasises regular training for extension service providers and calls for a comprehensive review of curricula in agricultural training institutions, it falls short of explicitly addressing the integration of climate change-focused activities into training curricula. This gap highlights a crucial aspect that needs attention to mainstream climate resilience expertise within the agricultural education system and extension services.

Uganda's Technical and Vocational Education and Training (TVET) Policy, introduced in 2019 by the Ministry of Education and Sports, articulates a commitment to addressing the country's socio-economic and environmental challenges. Despite this overarching goal, a visible gap exists in the policy concerning climate change education. While acknowledging the

necessity of overhauling curricula in TVET institutions and integrating crucial cross-cutting issues into all aspects of TVET (as outlined in priority area (d), p. 9), the policy surprisingly does not include climate change on the list of central issues. The primary focus of the TVET Policy appears to be on meeting market-driven labour demands, adhering closely to the ISCO occupational classification framework. This orientation raises concerns about the policy's ability to adequately prepare the workforce for the diverse and emerging challenges, particularly those related to climate change.

Similar to the TVET policy, Uganda Vision 2040 (National Planning Authority, 2013) emphasises the need for the government to enhance the relevance of training and skills orientation and periodically review the curriculum to align with industry needs. Even though Uganda Vision 2040 has reference to both climate change and extension services, it does not establish a direct link between extension services with climate resilience skills development. This gap suggests a potential limitation in the policy's capacity to address the holistic skills development required for climate resilience within the education system through VET.

From the analysis presented in Table 6.4, several other distinct observations arise:

First is the emphasis on technology and discrepancies with labour market information: Predominantly, policies on agriculture and climate advocate for the utilisation of technology to accomplish climate resilience objectives across areas such as agriculture, water management, and data dissemination. A glaring contrast is apparent when comparing this with the labour market analysis in section 6.8.1 and the role profile for extension officers in Table 6.2. The latter seems to barely recognise the need of addressing climate change.

Secondly, building capacity for extension services: Another significant policy drive is towards the enhancement of the capabilities of extension officers in climate resilience. This involves training in critical areas such as irrigation, water conservation, and deploying climate-smart agricultural technologies which is more pronounced in the National Adaptation Plan for the Agricultural Sector (MAAIF, 2018).

Third, integration of climate justice: Policies, particularly the National Agricultural Extension Strategy (NAES) (MAAIF, 2016), manifest an inclination towards climate justice, emphasising the support for vulnerable demographic segments- women, youth, and people with disabilities. These groups are pinpointed for capacity building to bolster their climate resilience.

Fourth, coordination and benchmarking on international frameworks: A recurring theme in the policies is the collaboration among diverse agencies and alignment with international policy frameworks. For instance, the evolution of the NAES and the Third National Development Plan (National Planning Authority, 2020) borrowed from global frameworks such as the Sustainable Development Goals (SDGs) and Africa Agenda 2063. However, a contradiction exists between policy formulation and implementation. Interviewed extension officers highlighted a gap between policy formulation and its practical realisation, as exemplified by the statement from UG-EO1, “They [policy formulation and implementation] are parallel. If there is a connection, then it is to a minimal extent. Uganda is good at making policies they do not implement, and that is what is happening here.”

Fifth, omission of Climate Change in TVET Policy: Despite VET institutions’ importance in developing skills for work, the TVET policy exhibits an unsettling omission of climate change and its ramifications on extension services. This raises questions about the alignment of TVET with national imperatives, especially in the agricultural sector. Agricultural and Business TVET colleges are popular for training extension officers in Uganda. Without foregrounding climate change, it is likely that extension students will not be inadequately prepared with climate resilience skills to support smallholders navigate climate-related issues.

Finally, influence on curriculum development: Policies like the Third National Development Plan (National Planning Authority, 2020) have demonstrably informed curriculum structuring at institutions like Gulu University, as mentioned in interview excerpts in section 6.6.3.1 of this chapter. The Uganda Vision 2040 (National Planning Authority, 2013) also foregrounds the need to progressively review the study curriculum and materials used to train students to reflect what the national and global industry needs. Nevertheless, the curricula review the policy mentioned is not specifically linked to climate resilience. It can only be assumed since the Uganda Vision 2040 is a broad policy framework.

In sum, the policy landscape in Uganda, as discerned from the analysis, displays an inclination towards integrating climate change considerations in the agricultural sector and foregrounds the importance of agricultural extension. The alignment with international frameworks underscores Uganda’s cognisance of climate change dangers and its resolve to counter them by fostering climate resilience skills and building a resilient extension service system. However, the practical implementation of these policies, especially in developing skills of extension officers, remains a matter of concern and warrants introspection.

Policy contradictions are also evident, particularly between key agricultural and climate policies, and the TVET policy. The former emphasise the urgency of addressing climate change and underscore the crucial role of extension services in assisting farmers. In contrast, the TVET Policy (MOES, 2019) does not reference extension or climate change. This disparity signifies a lack of preparedness within the VET system to integrate essential climate resilience expertise. Smallholder farmers and extension officers, in particular, require this expertise to effectively navigate the challenges posed by climate change. The disconnect between policy frameworks raises concerns about the education system's responsiveness to the pressing needs of those on the frontline of agriculture and extension services. Addressing this gap is pivotal for building a more robust and climate-resilient agricultural sector.

6.8 Chapter conclusion

This chapter provide an overview of Uganda's agricultural sector, charting the historical sociology of extension services, indicating that these services have witnessed remarkable transformations over time. Climate change remains one of the most challenges for Uganda's agriculture, casting shadows over the sustenance of smallholder farmers and the extension officers committed to supporting them. There are several potential strategies Uganda can adopt to revitalise its extension services. An analysis spotlighted the education extended to future extension officers, with the Bachelor of Science in Agriculture curriculum at Gulu University under the focus. Findings show that Gulu University's curriculum adequately integrates climate resilience into its academic content and practical engagements with students, with the curriculum's periodic revisions, as well as the collaboration with diverse stakeholders commendable. Empirical findings further revealed that on the ground, extension agents grapple with the effects of climate change, often feeling inadequately equipped and supported to guide farmers through the brunt of climate-induced challenges. Their narratives underscore an imperative need for further training focused on climate resilience. Observing the labour market dynamics, an imbalance was evident. The hiring requirements for extension officers seem to tilt more towards formal qualifications, inadvertently sidelining crucial aspects like core knowledge, competencies, and relevant skills. An analysis of the ISCO-08 framework further highlights this mismatch, its lack of contextualisation for Uganda's agricultural landscape is substantial. On a brighter side, Uganda's policy landscape provides hope for action against climate change except for TVET policy. The policies on climate and extension exhibit a robust

intent to confront climate effects, and there is a conscientious move to prioritise vulnerable social groups, such as women, youth and the disabled, echoing a deeper commitment to inclusivity in skills development. A key unresolved question pertains to the responsiveness of TVET colleges in Uganda towards climate resilience. Despite their critical role in providing agricultural and extension training, there is ambiguity regarding whether TVET institutions adequately address climate resilience in their curricula and training programs. This uncertainty is compounded by the observation that the TVET policy in Uganda, which serves as the guiding framework for these institutions, lacks explicit references to climate resilience. Thus, it remains unclear to what extent TVET colleges in Uganda incorporate climate resilience considerations into their educational offerings and whether they adequately prepare students to address climate-related challenges in agriculture. Further investigation and analysis are needed to assess the responsiveness of TVET colleges to climate resilience. Overall findings raise questions as to whether the occupation is adequately constituted as a primary mediating unit of analysis for skills planning and skills development in Uganda, and Gulu given the identified gaps in TVET policy and extension practice as findings suggested in this chapter. The next chapter abductively analyses the findings presented in Chapters 5 and 6 through use of the SEM and CHAT framework presented in Chapter 3.

CHAPTER 7: RE-IMAGINING OCCUPATION AS MEDIATING UNIT OF INTERVENTION FOR CLIMATE RESILIENCE SKILLS PLANNING AND DEVELOPMENT

7.0 Introduction

This study aimed to examine the adequacy of an occupation as a mediating unit for climate resilience skills planning and skills development, focusing on the Agricultural Extension Officer occupation. This research was structured to address this aim through objectives presented in Chapter 1, section 1.3.

The study began by undertaking a historical review of occupation as a mediating unit of intervention for skills planning and skills development, explored in Chapters 2, 5 and 6. Following this, the study examined current and historical descriptions of the extension occupation in Chapters 2, 5 and 6 in two VET cases; Alice in South Africa and Gulu in Uganda. Then, the study examined how VET preparation for extension work was taking place in response to the need for climate resilience through a curriculum review and the experiences and related work activities of extension services actors and presented the findings in Chapters 5 and 6. The study also reviewed agricultural extension, VET policy, and labour market data for its responsiveness to climate resilience and further presented the findings in Chapters 5 and 6. These all offered perspectives on the SEM for skills, its verticalities, horizontalities, and mediating institutions and processes.

This chapter extends the analysis offered in Chapters 5 and 6 and presents a comparative abductive analysis from the two case study sites, drawing on the theoretical framework developed in Chapter 3.

The chapter commences with a discussion of findings in alignment with the study's objectives, beginning with a review of the historical development of occupations as the primary mediating unit of intervention for skills planning and development in section 7.2. A description of the extension officer occupation as currently conceptualised and experienced follows this in section 7.3. This advances understanding of ecological time as found in SEM for skills. Section 7.4 focuses on how VET preparation for extension work takes place and the experiences of extension services work agents, offering perspective on mediating institutions in the SEM for skills and their mediating tools across the cases. Farmers experiences are included here,

offering perspective on horizontalities, and their connections to the extension officer's work. An analysis of the labour market and policy, explicitly targeting extension, VET and climate change, is presented in section 7.5 across the two cases, offering perspective on verticalities. In section 7.6, the SEM for skills for both Alice and Gulu are visualised and dissected using CHAT lenses applied in the SEM for skills. Here contradictions that are affecting the SEM for skills are pointed out, highlighting leverage points for further mediations in the SEM for skills in response to the need for increasing the facilitating potential of verticalities in service of climate resilience for farmers (i.e. where additional mediation at the 45 degree in the SEM for skills is needed).

Drawing on this analysis, the second to last section, 7.7, introduces the approach proposed by this thesis for more efficient skills planning and skills development. Section 7.8 concludes the chapter.

Overall, this chapter addresses objective five, which is based on insights from the prior four objectives, and the two cases. This objective sought to expand possibilities for a mediating unit of intervention for skills planning that has implications for skills development that would seem to be more relevant to climate resilience in agricultural extension.

7.1 Historical review of occupation as a mediating unit of intervention for skills planning and development

In line with the first study objective, this study reviewed the history of occupations as a primary mediating unit of intervention for VET skills planning and skills development. The historical analysis revealed that occupations are historically situated and exhibit features similar to those in medieval occupational guilds. Among the features of medieval occupational guilds prevalent in contemporary occupations is the control and structuring of trades, emphasis on quality through training, certification and licensing, and regulated entry into occupations. In addition, the use of state apparatus to regulate competition is a key feature of medieval occupational guilds.

Situating this into the local context especially in South Africa, for example, ancient occupational features mirror the existing state licensures and authority conferred by the government to professional bodies like the South African Council for Natural Scientific Professions. These bodies are tasked with regulating entry into occupations and overseeing

practice within those occupations, including agricultural extension which is regulated by the SACNSP as indicated in Chapter 2, section 2.6.3. The power and influence of these verticalities has implications for mediation within SEM for skills as they produce rules for the skills ecosystem.

Concerning the permeation of the occupational discourse into Africa's planning systems, historical analysis further showed that colonial powers introduced occupational discourse into African skills planning systems during Africa's colonisation, coinciding with the peak of the Industrial Revolution. Due to the influence of colonial governments, many Africans got engaged in commodity production and to further entrench their grip in these societies, colonial administrations introduced educational programmes to create administrative occupations for collaborators such as clerks and interpreters (see Chapter 2, section 2.5). For strategic political reasons, agricultural extension became, and is one of the most longstanding occupations in most African countries shaped also by colonial commodity productivism (refer to Chapter 2, section 2.5.1). Observing this historical pattern in South Africa and Uganda as shown in previous chapters 5 and 6 (see Chapter 5, section 5.2.3 and Chapter 6, section 6.2.1), the occupational discourse later was used as a socio-political weapon. For instance, in South Africa, when extension services were formalised in 1925, extension services and extension education were only accessible to White farmers excluding Blacks and Indians, triggering the development of parallel forms of extension services in the excluded social groups. In Uganda, colonialists collaborated with African traditional leaders to enforce cultivation of commodities, in return, orchestrating land reform in favour of cooperative leaders over the peasantries, especially in Buganda Kingdom.

Long after this occupational discourse was introduced to Africa, occupations gained prominence as the main unit of analysis for skills planning and development. Findings have shown that the labour markets, for example, utilise occupations (including extension) for recruitment purposes as exemplified by job adverts (see Chapters 5 section 5.6.1 and Chapter 6, section 6.7.1). These findings mirror those in other studies that suggest that occupations serve other functions, including resource allocation and monitoring, evaluation, and reporting (Ramsurup, 2020; Standing, 2009).

The findings underscore systems inertia that continues to exert influence on the present skills ecosystems due to using occupations as primary mediating units of intervention for skills planning and skills development. Their historical situatedness may provide insights into the

observed contradictions in policy and practice in both South Africa and Uganda, as facilitating verticalities in the form of policies are not aligned with place-based realities especially with the emergence of climate challenges in agriculture.

For instance, post-independence extension in South Africa experienced contradictions, with policies often oscillating between agricultural land reforms, livelihood rehabilitation, and market-centric agricultural strategies. Although some of these policies recognised environmental concerns (Chapter 5, section 5.2.2), it was not until recently that climate change was incorporated into broader policy as a fundamental threat to smallholder agriculture (Chapter 5, section 5.6.3). Similarly, Uganda's post-independence extension policy reforms were driven primarily by its volatile political atmosphere and World Bank-endorsed reforms like privatisation and decentralisation. These institutional reforms, as discussed in Chapter 6, section 6.2.7 heavily influenced extension policy, leading to contradictions between policy and place-based realities. Contradictions emerged because policies were developed according to the demands of the donor as opposed to the prevailing conditions on the ground.

The multiple, divergent perspectives of various actors with diverse interests in the different activity systems (Engeström, 1987) at the vertical, horizontal and mediating spaces in the SEM are hampering the integration of climate resilience skills and hindering the verticalities, from being more facilitating. These highlight deep seated structural tensions which shape contradictions in and between activity systems in the SEM. Engeström (1987) highlighted how contradictions impede the smooth functioning of interacting activity systems seeking to engage a shared object. In the two cases, contradictions were identified between policy activity systems, and the main mediating activity systems (education and extension) which constrain the education and extension activity systems from effectively addressing climate challenges found in the activity systems of farmers. This is significant because the two mediating activity systems with responsibility for education and training (education and extension) need to support farmers to build climate resilience.

Historicity of occupations and skills ecosystems brings to the fore the concept of ecological time in SEM for skills which elucidates how skills ecosystems and institutions evolve over long periods of time in response to the changing contexts (Spours, 2021). Similarly, as discussed in Chapter 3, CHAT emphasises historicity, highlighting how activity systems are shaped by historical and cultural contexts (Engeström, 1987). The historical analysis in this study has highlighted the importance of cultural- historical time in revealing the changes that

have occurred to the environment, and whether skills ecosystems are responsive or not, indicating the need for new thinking, planning and activity for climate resilience. As the world changes from Holocene and Anthropocene whose climate is predicted to be less stable and hotter (Meyer and Newman, 2020) climate change and its impacts will have implications for work and living, hence the need for climate resilience skills. While the agricultural environment in South Africa and Uganda has shifted due to the climate-induced impacts, the skills ecosystems and extension occupation remain deeply rooted in historical contexts and contradictions that are most evident from the inertia in the skills planning systems which as shown in the previous chapters, are out of sync with climate change and development policy in agriculture, and the realities of farmers. Ancient systems continue to exert influence, perpetuating rigid occupational structures that struggle to adapt to contemporary and future skills needs, particularly concerning climate resilience as findings in Chapter 5, section 5.6.2 and Chapter 6, section 6.7.2 reveal. These appears to be a temporal mismatch between cultural historicity of skills system instruments, and the temporality of climate change impacts as these are emerging and affecting farmers and food production, and thus also the work of extension services.

7.2 Description of the extension occupation

Regarding the second study objective on the current nature of extension officer occupation, findings showed that several aspects characterise extension occupation in Africa:

Firstly, findings reveal that extension services in Africa primarily support smallholder and small-scale farmers, with a significant majority being women (Abdu-Raheem & Worth, 2016). These farmers heavily rely on extension services to enhance and maintain their agricultural yields (see Chapter 2, section 2.6). The emphasis on assisting female farmers underscores women's critical role in agriculture, and as active players in the skills ecosystem, especially in the context of horizontal connectivities that need to be acknowledged in the planning and development of skills for an improved and sustainable agricultural sector. Brown's (2022) study on agricultural ecosystems in India reveals the need for horizontalities and verticalities that acknowledge marginalised social groups such as women, to address social inequalities and ensure more equitable outcomes in skill provisioning, development and utilisation.

Concerning the organisation of extension in Africa, findings highlight two aspects; first, in many African countries, agricultural extension has transitioned from a centralised government-

controlled system to a decentralised and pluralistic model. While governments remain primary providers, pluralism has welcomed a variety of non-state contributors like global agencies, NGOs, and private enterprises to deliver extension services. This diversification in service delivery stemmed largely from World Bank-backed reforms tied to loans, which encouraged policies like privatisation, economic liberalisation, and decentralisation (refer to Chapter 2, section 2.6.1). This change in approach aims to cater to the diverse needs of the agricultural community by drawing from a broader spectrum of knowledge and resources. In South Africa, for example, extension education has progressed, overcoming some of the historical segregationist challenges. As described in Chapter 5, section 5.2.3, currently, numerous agricultural institutions offer extension education. Similarly, in Uganda, since colonialism, extension has transformed. Earlier, chiefs and instructors were educated to bolster commodity production. Post-1962 independence, this education spread to most universities and TVET colleges.

In a pluralistic extension delivery where the government and private actors engage, the multiple actors operate mainly at three dimensions of the skills ecosystems. These are firstly found in the dimension of collaborative horizontalities in the SEM. These encompass community-based and international NGOs, as well as private businesses. Simultaneously, mostly local government agencies operating with and within agricultural activity systems and education activity systems can serve as extension and training providers as is the case of public extension delivery. They are often found to be active in facilitating horizontal activity systems, as can be observed in Figures 7.2 and 7.3. Secondly, actors are found in the dimension of verticalities in the SEM. Here government actors tend to establish rules and guidelines that govern the entire skills ecosystem, in this case, relating to agricultural extension. Thirdly, actors are found in the dimension of mediation in the SEM (the 45-degree mediation space in the SEM model). Here government and other training and extension providers also develop rules and tools that shape possibilities for extension (e.g. as found in the curricula in the ATI and Universities or in the training materials used to train farmers). Across all dimensions of skills ecosystem as Engeström and Sannino (2021) suggested, rules mediate the interaction between activity systems actors from multiple and diverse activity systems. Providing a set of regulations and expectations may help relationships and collaborations between different entities to emerge, but to ensure a more harmonious and effectively functioning skills system, rules should be less restrictive to allow flexibility and innovation for climate resilience.

Regarding the second aspect concerning organisation of extension in Africa, findings reveal that many African countries lack explicit, legislated extension policies and instead depend on implied or interim policies and guidelines written in government documents, academic works, and developmental organisation reports as indicated Chapter 2, section 2.6.4. These policies primarily encourage productivism, aiming to maximise output for profitability and agribusiness, with only marginal attention to sustainability and climate change, presenting a policy contradiction affecting the ability of the agricultural skill system to mainstream climate resilience. Like most African countries, a legislated, contemporary extension policy remains absent in South Africa. Unlike South Africa, findings show that Uganda has a legislated extension policy, as detailed in Chapter 6, section 6.7.3. In an ideal situation, for the verticalities to be more facilitating to the horizontal connectivities and mediating training institutions, these findings indicate the need for a legislated agricultural extension policy that foregrounds climate resilience.

Regarding the extension approaches in Africa, literature showed that across Africa there are diverse extension practices and approaches employed in the agricultural system. Extension professionals have adopted various strategies, including top-down, bottom-up, and participatory approaches, notably the Farmer-Field School model to facilitate skills development to farmers. Nonetheless, the Agricultural Innovation System (AIS) is rapidly emerging as the foremost model for extension service delivery, emphasising a demand-driven approach and integrating innovative, context-specific farming techniques, as discussed in section 2.6.2, with transformative mediation implications in the SEM for skills.

In addition, the top-down techniques during colonial times, which were characterised by enforcement led by colonial chiefs and agricultural instructors (see Chapter 6, section 6.2.2) have shifted to emphasise education and research in extension (section 6.2.6) which acts as mediator for agricultural skills development in the skills system. The role of government as an active facilitating vertical actor has been more pronounced through liberalisation of the skills ecosystem to encourage pluralism in extension sparked by World Bank institutional reforms. These nuances have also transformative mediation implications in the SEM for skills.

Regarding professionalisation of extension, findings show a departure from colonial-era practices where instructors shared information with farmers without prerequisites such as academic qualifications. Africa's evolving agricultural landscape now emphasises the professionalisation and regulation of extension. Today, extension practitioners are expected to

meet specific education and competence criteria. For instance, in South Africa, extension professionals are mandated to register with the SACNASP, ensuring their skills stay updated in a dynamically evolving agricultural landscape (see Chapter 2, section 2.6.3). Unlike South Africa, Uganda has no national professional body regulating extension officers' standards. Though the Directorate of Agricultural Extension Services offers advisory services, hiring qualifications largely depend on individual providers as described in Chapter 6, section 6.3. The emphasis on professionalisation aims to enhance the credibility of extension agents, who serve as the primary information sources for farmers. Within the skills ecosystem, professional bodies are positioned within vertical activity systems, exerting dominance over the relationship with collaborative horizontalities and mediators by setting and enforcing rules. This too has implications for skills development and mediation.

Finally, literature suggests redefining agricultural extension in Africa due to changing agricultural landscapes and climate change challenges. An expanded role for extension officers involves equipping farmers with tools and knowledge to adapt to the changing climate. In addition to transforming social and institutional bottlenecks to climate resilience, there is a need to enhance extension officers' technical, functional, and organisational competencies highlighted in Table 2.1, and fostering continuous professional growth. Conventional extension knowledge falls short in addressing the evolving climate challenges and farmers' needs, underscoring the demand for innovation and new skill-sets to enable transformative mediation in the SEM for skills. Literature has shown that agriculture in South Africa and Uganda grapple with climate-induced impacts, with smallholder and subsistence farmers shouldering the brunt. From diminishing water resources, erratic rainfall and yield reductions as shown in Chapter 5, section 5.3.1 and Chapter 6, section 6.4). The discussion on these revelations from literature is further expounded in the discussion of empirical findings in subsequent sections.

The findings on the description of extension services in Africa show that the occupation and skills ecosystems are historically situated and influenced. Most extension methodologies still focus primarily on boosting productivity and profitability without significant emphasis on ecological considerations. Most of this is inherited colonial legacies and failed neo-liberal policies that are producing tensions and contradictions in policies and practices. These contradictions have impeded climate resilience knowledge and skills among extension officers and farmers for a long period. The challenge ahead is harmonising these diverse influences to create a sustainable, resilient skills development framework that acknowledges the unique

challenges within the diverse African contexts and future skills needs. All of this calls for transformative mediation in the SEM for skills.

To minimise contradictions in policy and practice and enhance the effectiveness of facilitating verticalities in supporting horizontal connectivities and mediating training institutions, given the complex history of agricultural education and extension services in both South Africa and Uganda, the findings suggest a need for a legislatively mandated agricultural extension policy with a dedicated focus on climate resilience i.e. a more facilitating verticality instrument. This proposed policy framework would serve as a guiding structure, ensuring that the vertical activity systems within the skills ecosystem align with the evolving demands of climate-resilient agricultural practices. By establishing a legislative foundation for agricultural extension policies that specifically address climate challenges, it becomes possible to foster more rational interactions and collaborations between various actors in the skills ecosystem. Such a policy would provide the necessary impetus for aligning education and training programmes with the dynamic requirements of climate change, ultimately contributing to a resilient agricultural sector, in particular for smallholder farmers.

7.3 Responsiveness of VET preparation for extension work to climate resilience

As shown in Chapters 5 and 6, and as per the third objective of this research, I examined the study curriculum for the Diploma of Agriculture at FCAFTI and the Bachelor of Science in Agriculture at Gulu University. After this, I analysed insights from the Climate Resilience Assessment Tool, which students and lecturers from the institutions had worked with. This data encompassed insights from extension service actors' experiences and work activities. The subsequent sections present a detailed discussion of the insights and patterns observed from this comprehensive analysis, with emphasis on the mediation space in the SEM for skills as curricula are an important mediation tool in mediating institutions such as VET institutions of learning, as also illuminated by the extension agents' experiences, who in turn are tasked with mediating skills development for farmers.

7.3.1 Study curriculum's responsiveness to climate resilience

Overall, curricula review results indicated the need for more support and flexibility on approving the curricula from facilitating verticalities (i.e. skills authorities) to enable integration of climate resilience expertise. The study finds that the curricula for the Diploma in Agriculture and Bachelor of Science degree programs, which train extension officers in Alice

and Gulu, require improvement in responsiveness to climate resilience. However, the extent of necessary curriculum enhancement varies between the two programs.

In the Diploma in Agriculture curriculum at FCAFTI, a discernible inadequacy in climate change themes was observed, particularly within the animal production and agribusiness specialisations. Contrastingly, the crop production specialisation manifested a satisfactory incorporation of such themes, as documented in Chapter 5, section 5.5.1. This observation was further corroborated by the Climate Resilience Assessment Tool, wherein the crop production specialisation was found to be more attuned to climate resilience compared to the former two (refer to Chapter 5, section 5.5.2, Figures 5.1-5.3). Moreover, aspects of curriculum delivery, encompassing community engagement, research, and innovative approaches, were identified as areas necessitating an improvement in their climate resilience responsiveness. As per Figure 5.3, the curriculum's present composition fails to fulfil the requisites of climate resilience responsiveness, warranting substantial revisions. These assertions were echoed in interviews with lecturers and extension officers, and many opined that the curriculum's engagement with climate change remained sidelined and deserved more attention (Chapter 5, section 5.5.3.1). A notable critique emerged from a pedagogic perspective, wherein a lecturer alluded to the curriculum as reflective of agricultural practices indicative of the 1980s and 90s. This hints at the curriculum's datedness, making it an ill-suited mediating tool for extension skills development required to address contemporary climate challenges, such as frequent droughts and water scarcity prevalent in Alice. Such an outdated orientation might compromise the preparedness of future extension officers to address the pressing climate challenges faced by smallholder farmers.

This curriculum's seeming oversight of climatic and sustainability themes resonates with Rosenberg's assertions (2020a). Rosenberg posited a concerning trend among South African extension officers, attributing their apparent lack of sustainability knowledge to its glaring omission from the study curriculums of agricultural TVET colleges. In a broader context, inadequate extension curricula may be contributing to the extension officers' current lack of skills in documenting knowledge and contributing to research in their field of practice as Mutimba (2014) claims. Curricula are therefore key transformative instruments in the SEM for skills mediating space.

These findings from Alice reveal a significant gap in South Africa's skills ecosystem concerning the current extension training curriculum and its responsiveness to complex climate

problems. The Climate Resilience Assessment Tool results indicate an inconsistent integration of climate resilience topics across Diploma specialisations, suggesting graduates might be ill-prepared for real-world challenges facing farmers, mainly climate change. This misalignment is concerning, given the perceived critical role of agricultural VET colleges in agricultural skills development. In addition, the inadequacy of the curriculum's climate resilience responsiveness is concerning given that a study curriculum, according to Cong-Lem (2022) and Engeström (1987) is considered a tool that mediates the understanding and transformation of the object, which in this context is building resilience to climate. Rosenberg's (2020a) observations further underscore broader implications: a deficient foundational education can have widespread repercussions in the agricultural sector. For areas like Alice and even South Africa at large, to effectively tackle the impacts of climate change, mediating VET institutions for skills development must urgently realign their curricula to the needs of agriculture in light of emerging climate challenges to build climate resilience skills, a finding also discussed in Pesanayi (2019).

The current Diploma curriculum is demonstrably biased towards an industry-centric approach with capitalistic orientations, as articulated in Chapter 5, section 5.5.1. This inclination posits that the knowledge acquired by extension students from FCAFTI is better suited for urban industrial settings or large-scale commercial agriculture rather than the predominantly smallholder-farmer-centric local markets characteristic of the South African agricultural landscape, and specific to Alice. Such observations resonate with the insights of Lotz-Sisitka and McGrath (2023), who argue that institutions like FCAFTI, deep-seated within the public VET system, manifest an urban and industry-driven orientation (cf. also Pesanayi, 2019). This orientation is not suitable for the pressing demands of rural smallholder communities, which need extension services tailored to bolster climate resilience. When the extension curriculum is framed with a pronounced bias towards urban commercial markets, one can infer that climate-related aspects might be neglected, especially for the smallholder farmer. The findings may suggest that the VET institution and curricula may not be effectively mediating agricultural skills development within the skills ecosystem. However, this inadequacy could be a result of external factors influencing the skills ecosystem beyond FCAFTI's control as will be discussed later in this chapter.

From a historical perspective, these observations may mirror south Africa's past education system and curriculum for colleges like FTAFTI, which predominantly have produced labour for commercial farmers despite its physical location in smallholder communities. The focus on

commercial agriculture by the curriculum indicates a misalignment with the needs of its target market who are smallholder farmers. Transformative efforts within the skills ecosystem, beginning with a curriculum update to reflect current realities, are required to ensure that extension services remain relevant and beneficial, particularly for those vulnerable to the impacts of climate change.

Other external factors such as inadequate funding and personnel were found to impede effective curriculum implementation, resulting in a curriculum that inadequately addresses climate resilience. Financial and human resource constraints impede the college, as detailed in Chapter 5, section 5.5.3.2. With resources adequately provided for climate-related activities, students would potentially have more opportunities to participate in practical activities related to climate resilience, such as hands-on training and educational excursions. The FCAFTI's Strategic Plan (2021-2025) indicates that the Department of Agriculture, Land Reform and Rural Development provides approximately 80% of the college's budget (FCAFTI, 2021). This significant contribution by the Department of Agriculture suggests that it likely wields considerable influence over budgetary allocations within the college, potentially steering funding towards specific educational initiatives unrelated to building climate resilience skills. The existing model of funding for public TVET colleges, championed by the Department of Agriculture, draws attention to the inherent weaknesses of the VET 3.0 development and its financing approach (Lotz-Sisitka & McGrath, 2023). The South African educational structure remains firmly entrenched within this paradigm, as VETAfrica 4.0 Collective (2023) findings posit, a situation I argue aligns with the occupational discourse employed as a primary mediating unit of intervention for skills planning and skills development in South Africa.

These findings underscore the entrenched institutional bureaucracy of national level verticalities, impeding their facilitating potential, causing substantial delays and complications in updating the curriculum with climate-related content at FCAFTI, as described in Chapter 5, section 5.5.3.3. Such bureaucratic impediments, specifically in updating the curriculum, might suggest inherent tensions within the social skills ecosystem. Here, vertical structures, or 'facilitating' verticalities, potentially have conflicting priorities with collaborative horizontalities or mediating learning institutions. Given the hierarchical nature of the curriculum review and approval process, these tensions or contradictions (as shown in Figure 7.2 denoted by lightning symbols) inevitably manifest (see Chapter 3, section 3.2.4). Furthermore, the actors within vertical activity systems, exemplified by the Department of Agriculture, in their role as allocators of financial and human resources over mediating training

institutions like FCAFTI and extension services, may highlight the boundedness of mediating actors by (non)facilitating verticalities. This shows the constraints and dependencies that exist within the skills ecosystem, suggesting that the actions and decisions of key stakeholders at the vertical level significantly influence the functioning and effectiveness of training institutions and extension services. The considerable influence wielded by these vertical actors further underscores the importance of having better facilitating verticalities to create a cohesive skills ecosystem to climate navigate challenges by building resilience in agriculture. It shows the need to focus in on the concept of ‘facilitating’ when it comes to verticalities.

Drawing on Engeström’s (1987) assertion, such contradictions arise when an established division of labour, characterised by its rigid hierarchical structure, confronts innovative methods or instruments that promise transformation. The findings reveal that principal vertical actors in this dynamic, notably institutions such as the DHET and the CHE, dominate the curriculum approval process. This centralised control complicates and often impedes the agility of educational entities in updating their curriculum, which is a mediating tool for skills development in the skills ecosystem, as findings further elaborate in Chapter 5, section 5.5.3.3.

This complex curriculum review process for climate resilience in Alice reflects the inherent ‘multi-voicedness’ in the skills ecosystem. Varied stakeholders populate this ecosystem with their distinct levels of influence, vested interests, and perspectives on the curriculum. Engeström (2001) posited that even though actors within an activity system might share a collective aim, their individual histories, views, and vested interests often become sources of internal contradictions (see Chapter 3, section 3.2.4).

Given the funding inadequacies and the influence of verticalities that are rooted in historical legacies mentioned above, there is a need to reconsider occupational structuring and associated funding models. This rethinking is essential for effectively addressing current and future skills requirements and for equipping the next generation of extension agents with the necessary knowledge, skills, and tools to navigate the challenges posed by climate change in an uncertain future. An extended or re-imagined skills planning mediating mechanisms that has implications for skills development could diversify the curriculum to include more progressive, climate-focused strategies and adaptive technologies instead of reliance on a limited occupational approach that does not necessarily prioritise emerging climate challenges as shown by Lotz-Sisitka and Pesanayi (2020) and Pesanayi (2019).

From a broader perspective, the study's findings illuminate the existence of numerous activity systems within the overarching skills ecosystem in South Africa, as Figure 7.2 shows. Each activity system is populated by actors- individuals, groups, or institutions with diverse histories and objectives. Such heterogeneity validates the study's observations regarding the intricate curriculum review process. Furthermore, it underscores the historical datedness of the curriculum, reinforcing lecturers' assertions that it may still be catering to the agricultural needs of the 1980s and is arguably misaligned with present-day climate imperatives in agriculture.

The curriculum analysis for the Bachelor of Science in Agriculture at Gulu University in Uganda presented some noteworthy results. As detailed in Chapter 6, section 6.6.1, the programme adequately incorporates themes of climate resilience. This assertion is substantiated by the review of the curriculum using the Climate Resilient Assessment Tool, which, except for the research and innovation section, found the curriculum to possess a commendable focus on climate resilience (refer to Chapter 6, section 6.6.2). Such findings are further validated by interviews with lecturers and extension officers, who concur on the programme's substantial integration of climate-related topics (Chapter 6, section 6.6.3.1).

Intriguingly, a closer analysis of various curriculum components using the Climate Resilience Assessment Tool revealed that policy directives significantly shape the curriculum review and update process, a departure from experience in South Africa's case. In its endeavours to keep the curriculum updated, Gulu University aligns its content with international, regional, and national policy priorities concerning climate change. This alignment is evident in the university's adherence to global policy frameworks like the Sustainable Development Goals and regional directives like the Africa Union Agenda 2063, in tandem with national policies like Uganda's Third National Development Plan (as mentioned in Chapter 6, section 6.6.3.2). Such alignment is possible due to the flexibility offered by the National Council for Higher Education (NCHE), allowing universities to modify up to 30% of the curriculum before the quinquennial review. The findings may suggest that the skills ecosystem verticalities are more facilitating, and the flexible rules in form of guidelines provided by the National Council for Higher Education on curricula review have enabled Gulu to work with horizontal connectivities to integrate climate resilience expertise into the study curriculum.

Contrastingly, the situation in Alice is different. A noticeable difference between the two cases in Uganda and South Africa concerns the role and impact of the skills ecosystem facilitating verticalities in curriculum development. Here, vertical actors, primarily from educational

bodies like the DHET and CHE, impose stringent guidelines, significantly hampering the responsiveness of the curriculum review process, especially concerning climate resilience at FCAFTI. This difference may suggest that verticalities in South Africa need to be more facilitating of the curriculum development or update process.

Interviews with lecturers shed light on the adaptive nature of curriculum implementation at Gulu University, aiming to equip students with agribusiness acumen and climate resilience competencies. This focus prepares them to create sustainable social enterprises, bolsters them economically and ecologically and enables collaboration with farmer communities. As detailed in Chapter 6, section 6.6.3.3, this student-farmer attachment model fosters enhanced interactions between farmer and student groups, especially in community engagement and innovative research. This collaboration aligns with overarching national goals, such as fostering youth participation in agriculture, a sentiment echoed in the National Development Plan (2020). The visibility of Business Activity system as shown in Figure 7.3 may also suggest an increased role of horizontal connectivities in working with Gulu University to align policy priorities with the curricula to be more responsive to the labour market.

Furthermore, Gulu University has showcased mediation leadership in the skills ecosystem, fostering stakeholder collaboration, the findings that align with the discovery by Lotz-Sisitka et al. (2023). Serving as the linchpin, the university harmonises interactions between vertical entities like the NCHE, DAES, and the Gulu district education office and the horizontal actors, predominantly the farming community. This collaboration manifests as transformative activities that seek to transform curriculum as a mediating tool for skills development. In the broader view, it is evident that actors from diverse activity systems interact within the skills ecosystem. The interactions among ecosystem actors in Gulu, rich in cultural significance and reflecting historical evolution, are instrumental in promoting climate resilience skills development in the study programme. This intricate interplay of factors, as indicated by Ala-Laurinaho and Koli (2007) and Engeström (2005), is pivotal in ensuring the ecosystem's responsiveness and adaptability to evolving challenges and opportunities.

Interestingly, a prior study by Kalule and Ongeng (2016) on the Bachelor of Science in Agriculture curriculum at Gulu University offers complementary insights. Their findings highlight the significance of the student-farmer attachment model. It augments the university's ties with local communities and plays a pivotal role in uplifting local livelihoods. However, a differentiation emerges when comparing the current study's findings with those of Kalule and

Ongeng (2016). The latter focused more on students' job market readiness, sidestepping the crucial aspect of climate change and its implications for agricultural sustainability. Still, Kalule and Ongeng (2016) underscore the indispensable role of extension officer skills training, advocating for a curriculum that churns out graduates possessing academic knowledge and practical employability skills tailored to the farming community's needs.

Drawing a parallel between the curriculum for the Diploma in Agriculture FCAFTI Agricultural College and Gulu University's Bachelor of Agriculture, one can discern disparities, especially concerning the emphasis on community engagement. The former's approach leans more towards industry alignment and commercial farming. At the same time, Gulu's curriculum is deeply entrenched in community engagement, prioritising learning and knowledge production in resilience and sustainable farming practices. This indicates that Gulu works closely with horizontal connections of the skills ecosystem.

The findings on curriculum analysis for Gulu University's Bachelor of Science in Agriculture are significant in both Gulu and Alice's narrow and broader contexts. Gulu University's curriculum has proactively integrated climate resilience themes, positioning itself at the forefront of tackling climate change impacts, save for the climate communication aspect of the curriculum. This is laudable, considering the profound implications of climate change for agriculture, especially in countries like Uganda that heavily rely on farming.

The relationship between curriculum and policy is pivotal. Gulu University's approach of aligning its curriculum with national and international policy directives ensures that education is both relevant and future-oriented. It signifies an institution responsive and adaptive to the evolving agricultural landscape, acknowledging the global push towards sustainable and climate-resilient practices. Furthermore, the flexibility provided by Uganda's National Council for Higher Education (NCHE) proves crucial in enabling such adaptability, contrasting sharply with the rigidity faced by FCAFTI in Alice, South Africa. This difference underscores the vital role of facilitating verticalities and an adaptive mediating frame for skills planning in driving curriculum reform. A less flexible skills ecosystem, as seen in South Africa, can stifle innovation and swift responsiveness, which are critical in addressing the challenges of climate change in agriculture (Pesanayi, 2019). The contrast between the two countries' verticalities responsiveness highlights the importance of flexibility, stakeholder collaboration, and forward-thinking in a concerted activity on climate. FCAFTI could benchmark from Gulu to improve

on aspects such as aligning policy priorities and connecting better with horizontalities to improve its curriculum concerning climate resilience.

7.3.2 Experiences and related work activities of extension services actors

Another aspect of Objective 3 of this study (see Chapter 1, section 1.3) involved examining extension agents' experience and related work activities concerning climate resilience. Obtaining these aspects involved conducting interviews with extension officers, farmers, and lecturers in both cases.

The findings articulated in Chapter 5, section 5.5.4 and Chapter 6, section 6.6.4 present a detailed understanding of smallholder farmers' challenges amidst the changing climate. Variations in planting seasons, droughts, and water scarcity are common challenges. Particularly in Gulu, the situation is exacerbated by frequent flooding and crop pest invasions. This is linked to rampant deforestation, as corroborated by the VETAfrica 4.0 collective (2023), which attributes this deforestation to the thriving charcoal market in neighbouring districts. As portrayed in Chapter 5, section 5.5.4 and Chapter 6, section 6.6.4, farmers' expectations towards extension officers have evolved from mere knowledge transfer to helping them navigate climate challenges in both cases. Echoing the insights of Shaxson et al. (2012) described in Chapter 2, section 2.6.5, farmers anticipate these officers not only to disseminate farming information but also act as innovation brokers, knowledge intermediaries, and collaborators, merging indigenous knowledge with modern practices to ensure agricultural productivity and climate resilience. However, this heightened expectation confronts a gap. As reflected in their responses (see Chapter 5, section 5.5.4 and Chapter 6, section 6.6.4), extension officers confess a limited exposure to climate-smart innovations and a substantial lack of centralised climate data repository. The current dependence on informal learning avenues, predominantly facilitated by NGOs and other higher learning institutions, underscores a gap in their formal training and support from their employing institution. However, it demonstrates the harmonious connection of collaborative horizontalities in breaking away from restrictive rules as well as and labour market demands instituted by verticalities to act on climate resilience.

Consequently, in both cases even as actors appear to be gradually moving away from traditional occupational frameworks (as evidenced by the increased informal learning mediated by educational institutions and NGOs), the pressing need remains for a more flexible and adaptive mediating unit of intervention for planning and developing skills for these extension officers

to obtain enhanced training, and climate resilience knowledge and skill sets to effectively tackle the evolving and complex challenges posed by climate change.

A critical revelation from experiences of extension officers especially in Alice is that smallholder farmers face significant barriers in securing finance for innovations aimed at climate resilience, as Chapter 5, section 5.5.4 illustrates. This challenge is mirrored in studies by Chisoro-Dube, Roberts and Brief (2021), Beukman and Reeler (2021) and Makgetla et al. (2019). The latter identified the limitations of smallholders when compared to commercial farmers: the resources available to invest in climate-smart strategies are notably sparse. Chisoro-Dube et al. (2021) also noted that South African smallholders could realistically adopt these climate-focused technologies only if sustained by governmental support or alternative financial mechanisms. An earlier study by Makgetla et al. (2019) articulated that commercial farmers in South Africa tend to be insulated from the ramifications of climate change, unlike their smallholder counterparts. Extension officers in Alice highlighted that their capacity to assist is often constrained by the profile of the farmers they serve. Specifically, they noted that smallholders' lack of resources and financial challenges hinder them from accessing climate-resilient technologies, subsequently limiting the officers' exposure and experience in these areas. These findings on the lack of finance in Alice are affirmed by Chanyau and Rosenberg (2023) who highlighted that women farmers are resorting to employing low-cost agroecology-informed extension to navigate climate challenges due to lack of climate financing. This challenge has also been highlighted in high-level policy reports including the Presidential Climate Commission (2022) report which indicates a glaring inadequacy in investment for under-resourced farmers and a dearth in capacity-building programmes. Makgetla et al. (2020) revealed that by 2010, 50 000 commercial farmers dominated the market, generating 70% of agricultural income. These findings show that verticalities are not effectively facilitating access to financing for smallholders.

The inequalities between the two farmer groups in South Africa confirm what has already been revealed in literature as an issue deeply rooted in unjust colonial and apartheid legacies of the past. Mamdani (1996) detailed how Black farmers faced institutionalised segregation powered by legislative measures and market constraints. Pivotal Agricultural Development Acts spanning from 1904 to 1907 actively disenfranchised Black individuals, withholding financial aid and land access. Hall (2003) and Mamdani (1996) further recounted how the government implemented policies that selectively disadvantaged Black smallholders to shield White commercial farmers (refer to Chapter 5, section 5.2.2). The scars of these historical injustices

are still evident today, especially under the strain of climate change, which disproportionately burdens the already disadvantaged smallholders, leading to a severe climate injustice. An investigation by Mahlalela et al. (2020) reinforced this, establishing that climate-triggered droughts have deeply impacted economically strained rural regions of the Eastern Cape, areas that had been historically underfunded during the apartheid era. This continuum of skills and socio-political dynamics over time manifests the slow evolution of South Africa's skills ecosystem, which, to a significant extent, still bears the weight of its colonial past.

The historical situatedness of the skills ecosystem reflects the legacy of colonialism and apartheid and poses a significant impediment to the responsiveness of the skills ecosystem to the demands of climate resilience. These findings underscore the pressing need for systemic overhauls and a nuanced understanding of the historical context, particularly the enduring effects of colonialism. Such an understanding would be vital for making verticalities more facilitating, adaptive and responsive in the development of climate resilience skills using approaches that can effectively address the challenges imposed by the changing climate. Addressing historical legacies and adopting forward-looking strategies will be crucial for creating a skills ecosystem that is better equipped to meet the demands of a dynamic and evolving climate landscape.

In Gulu, the findings underline a multi-dimensional challenge, where economic constraints, historical legacies, and financing deficiencies converge to limit the adoption of climate-resilient practices among smallholder farmers. While poverty restricts access to innovative technologies (Chapter 6, section 6.6.4), it is also evident from Branch (2013) that many smallholders still employ old-fashioned farming methods. This stagnation is partly due to chronic underfunding of crucial agricultural sectors, a trend noted over decades (Lukwago, 2010). The East and South Africa Small-scale Farmers' Forum (ESAFF, 2021) points out the stark contrast between the meagre financial allocation to the agricultural sector and its substantive contribution to Uganda's GDP and employment. The statistics highlighted that despite agriculture's vitality in employing almost 80% of the country's workforce and constituting 25% of the National GDP, in the 2020/2021 fiscal year, the government allocated a mere 3.7% (ESAFF, 2021).

In addition to the limited government budget allocation for agriculture, Gulu smallholders' lack of access to climate finance and infrastructure can be attributed to its fragile local economy, which is still grappling with the aftermath of a 20-year civil conflict, as noted by Löwe and

Phiona (2017). Furthermore, the termination of programmes like the Peace, Recovery and Development Plan (PRDP), which supported local farming communities post-conflict, adds another layer of vulnerability (Slotkin, 2017). Such financial constraints and historical traumas serve as barriers in the skills ecosystem for climate resilience. They hinder the facilitation of relevant training access to technology and the development of expertise needed for modern, climate-resilient agriculture.

Uganda's agricultural sector reveals the enduring impacts of earlier VET models associated with occupational discourse and development financing, akin to trends seen in South Africa, as Lotz-Sisitka and McGrath (2023) have highlighted. Historical engagement with World Bank reforms, emphasising policies like decentralisation, economic liberalisation, and privatisation (Chapter 2, Section 2.6.1), inflicted substantial budget cuts, weakening Uganda's public agricultural extension system (Nkonya et al., 2020). This inadequate allocation hampers the potential for innovation in climate resilience among the horizontal connectivities, rendering the skills ecosystem ill-equipped to adequately address contemporary climate change challenges. Thus, past economic and political reforms and developmental decisions, intertwined with historical situatedness of enabling verticalities, continue to constrain Uganda's skills ecosystem and its capacity to respond to climate resilience skills demands.

7.4 The labour market, occupational classification frameworks and policy analysis

7.4.1 Labour market analysis

Objective 4 (see Chapter 1, section 1.3) of the study explored the adaptability of policy and labour markets to climate resilience in South Africa and Uganda. Labour market analysis involved two key areas: 1) occupational recruitment, which assessed job listings to understand if employers prioritised climate resilience, and 2) occupation structuring, analysing occupational classification systems – South Africa's Organising Framework for Occupations (OFO) and for Uganda, the International Standard Classification for Occupations (ISCO-08) – to discover how occupations were organised and described and whether existing frameworks foreground climate resilience as a concern.

Labour market analyses from South Africa's skills ecosystem (Chapter 5, section 5.6.1) and Uganda (Chapter 6, section 6.7.1) indicate a pronounced emphasis on academic qualifications for extension officer roles. Within both countries, academic credentials are a vital criterion for hiring extension officers. Entry-level extension jobs necessitate basic academic qualifications

of a Diploma in Agricultural extension, while senior roles demand advanced degrees in extension. For instance, a Chief Director Agricultural Services role (job Advert 1) in South Africa mandates at least a Bachelor's degree, preferably augmented by an Honours degree, as illustrated in Chapter 5, Table 5.4. In contrast, junior roles settle for an agricultural diploma at NQF level 7. Uganda mirrors this trend; while non-public employers might accept diplomas for entry-level roles, the public sector typically insists on Bachelor's degrees, and senior roles can require up to PhD qualifications, as highlighted in Chapter 6, Table 6.2.

In both South Africa and Uganda, interviewed extension officers met the academic requirements outlined in job advertisements (refer to Chapter 4, Tables 4.2 and 4.3). South Africa delineates qualification criteria within its OFO and other official directories like the Department of Public Service and Administration (DPSA) and the Department of Higher Education and Training (DHET) careers advice portal (Chapter 5, Table 5.6 and Chapter 4, Table 4.5). Conversely, Uganda lacks a formalised occupational framework, with qualification requirements sourced from job adverts and specific Directorate of Agricultural Extension policy guidelines (see Table 6.2). According to literature, this trend is consistent with other African countries, where the extension officer occupation is increasingly becoming formalised, necessitating specific academic certifications and being overseen by professional bodies as highlighted in Chapter 2, section 2.6.3 by Davis and Terblanche (2016), Klazinga (2000), Shemfe and Oladele (2018), and Olorunfemi and Oladele (2021). South Africa's professional criteria and accreditation requirements for its extension workforce are detailed in Chapter 5.2.3.

The labour market analysis reveals a hierarchical structure within the skills ecosystems where the extension officer occupation's entry requirements are defined in descending order of priority, beginning with academic qualifications, followed by tasks, core knowledge, skills, and then competencies (refer to Figure 7.1 below). This systematic approach embodies vertical top-down control by enabling verticalities, inherently determining the types of knowledge and skills considered integral for the extension role. Such a structured prioritisation potentially restricts the scope of expertise and knowledge within the extension field of practice. Moreover, these framings influence what is valued in the occupation, shaping its trajectory and potentially sidelining crucial but under-emphasised skills or competencies such as climate resilience. This configuration has broader implications on the skills ecosystem's planning and development skills, possibly leaving gaps in addressing contemporary climate change challenges.



Figure 7.1: Extension Officer Occupation requirements in terms of importance in South Africa and Uganda
 Source: Author

The labour market analysis underscores a notable deficiency in the demand for climate resilience expertise and skills in South Africa and Uganda’s job vacancies. Specifically, references in Chapter 5, section 5.6.1 and Chapter 6, section 6.7.1 underline this gap. This trend in Uganda resonates with a broader observation made by the International Labour Organisation (ILO) in 2018. The ILO report indicates that Uganda lacks a comprehensive system or dedicated institution responsible for identifying present and future skills requirements, both for traditional roles and the emerging centred around green, environmentally-focused jobs. This deficiency underscores a potentially critical oversight given the growing importance of climate resilience in the face of climate challenges, again reflecting the temporality mismatch noted above.

A disparity exists between the emphasis on climate resilience in national policies on extension and VET and actual job requirements in both South Africa and Uganda. While policy findings highlighted in Chapter 5, section 5.6.3 and Chapter 6, section 6.7.3 underscore the significance of climate resilience and advocate for climate action in agricultural sector extension service delivery, this priority does not translate to the labour market’s demands for extension work.

These findings are significant in highlighting the prevalent contradictions between policy and labour market and activity on ground by horizontal connectivities. Although policy has evolved to highlight the need for climate resilience skills in extension and broader agriculture and

horizontal activity systems working together to break away from limitations to act on climate, the labour market is still entrenched in historical and inflexible orientations that emphasise productivism with less emphasis on sustainability.

On a positive note, the labour market analysis of South Africa and Uganda revealed distinct workstreams within the agricultural extension field of practice. Several knowledge and skill sets were identified by assessing job advertisements and associated academic qualifications, both formal and informally obtained (workstreams defined in Chapter 1, section 1.6). These aspects were subsequently categorised into broader workstreams necessary for effective functioning of the skills ecosystem on agriculture concerning climate resilience: monitoring and evaluation, agricultural research, agricultural production and value chain, policy, community liaison, and marketing and agribusiness. Notably, due to their diverse academic and occupational underpinnings, these workstreams exhibit a potential adaptability to climate resilience, in contrast to the existing rigid occupational structure. Furthermore, while analysing related occupations to the extension officer role, distinct knowledge requirements emerged, which solidified Blum et al.'s (1988) notion, referenced in Chapter 2, section 2.1, that occupations vary based on tasks or specialisations.

7.4.2. Analysis of occupational classification frameworks

Occupational classificational structures were analysed to understand the structural framework underpinning the functioning of South Africa and Uganda's skills ecosystems. Specifically, the study investigated systems like the Organising Framework for Occupations (OFO) in South Africa and compared it with relevant frameworks in Uganda, mainly the International Standard Classification for Occupations (ISCO) published in 2008. By analysing these occupational structures, the study could discover how occupations were organised and whether existing frameworks addressed or integrated climate resilience in their descriptions or not. This provided an understanding of how occupations were categorised and described and whether climate resilience was entrenched in occupational roles or remained sidelined.

The findings showed that occupations seem to be structured into a framework without substantive information on climate resilience. In South Africa, while the OFO is adapted from ISCO for both public and private sectors to plan and develop skills, its practical application is challenging, as discussed in Chapter 2, section 2.5.1. This complexity has led the Department

of Public Service and Administration (DPSA) to design an alternate Occupational Classification System (OCS) to function alongside the OFO.

The 2021 OFO's introduction of new agricultural occupations, as outlined in Chapter 5, section 5.6.2, emphasises state interventions' role in shaping the occupational landscape. The DHET's creation of new occupations indicates historical and governmental influences highlighted in Chapter 2, section 2.4. This perspective resonates with Kuhlmann's (2013) contention that the evolution of certain occupations may result more from political interventions than natural industry progression. Abbott (1993) further argued that such occupational structures and the creation of controlling hierarchies are often a direct consequence of governmental involvement in organising work.

The new occupations introduced closely resemble the extension officer occupation. As discussed in Chapter 5, section 5.6.2, this decision led to atomised occupations and further narrowed the depth of the extension officer's role. Instead of enhancing this role with essential climate expertise, the scope was reduced. While Standing (2009) suggested that occupations tend to be over specialised knowledge, findings indicate that extension officers often lack this expertise and identify as generalists without any form of specialised knowledge, frequently relying on specialists from the Department of Agriculture to assist in farmer information sessions (Chapter 5, section 5.5.4). This deficit might highlight their climate resilience skills gap, a notable impediment to adequately supporting smallholders. Wheelahan and Moodie's (2018) insights on the importance of knowledge specialisation echo this concern, emphasising the need to preserve domain-specific knowledge.

Similarly, Shalem and Allais (2018) highlighted the potential risks of a purely generic education system, suggesting it could limit employment prospects. Thus, balancing specialisation with flexibility in training extension officers is essential, especially considering evolving climate challenges. This thesis aligns with this argument, underscoring the importance of equipping extension officers with comprehensive sustainability skills and expertise with a reasonable level of specialisation to enhance smallholders' climate resilience.

In contrast to South Africa, Uganda has not extensively adapted the ISCO-08 framework, except in specific areas like housing and population census. Rather than adhering to a rigid occupational framework, Uganda's public and private sector employers recruit for extension services based on immediate local skill demands. A noteworthy observation is that some job descriptions in advertisements deviate from the conventional extension officer (EO) role. This

divergence became evident when comparing the role specifications of agricultural technicians with related occupations within the ISCO-08 framework.

Overall, labour market analysis (labour market information and occupational frameworks) offers two key observations. Firstly, academic qualifications primarily determine the entry into and upward progression within the extension officer occupation. This potentially restricts hiring individuals possessing critical skills and knowledge attained from uncredited non-formal learning or indigenous insights despite lacking formal academic credentials. This observation resonates with Standing's (2009) idea that certain occupations have the authority to shape training and recruitment criteria, suggesting the extension officer role might undervalue indigenous knowledge, contrary to Standing's recognition of such valuable but inferential knowledge.

Secondly, current occupational structures seem deeply rooted in historical practices. In line with the historical review, contemporary occupational classification frameworks mirror this historical evolution from 17th and 18th century occupational systems such indicated in the Masse and Patrick Colquhoun Occupational Tables (see Chapter 2, section 2.5). This highlights that historical occupational guilds and ancient occupational systems such as the ones mentioned above are precursors to today's occupations and occupational classification systems that have transitioned into global and national classification structures like ISCO and OFO. Like these ancient occupational systems, contemporary occupational frameworks categorise occupations with specific professional and qualification requirements, making them too controlling as elaborated in Chapter 2, section 2.4. The historical situatedness and controlling nature of these occupational frameworks may explain their inflexibility in accommodating contemporary aspects of climate resilience required for developing skills for extension work to deal with climate-induced challenges facing farmers. This aspect will be further elaborated on in subsequent sections.

For effective transformation, Engeström (2010) emphasised the importance of first understanding the historical underpinnings of these systems, a perspective that this thesis has developed.

More broadly, these findings underscore the influence of verticalities on the skills ecosystem, wherein collaborative horizontalities and mediating VET institutions are compelled to adhere to the prescribed rules set in vertical activity systems crafted by institutions such as DHET, the Department of Agriculture, and other national planning authorities responsible for policy

formulation. The historical context shaping these system formations and verticalities in both South Africa and Uganda aligns with Engeström's (2001) and Spours's (2021) assertions that activity systems and skills ecosystems undergo long-term evolution. Friedman's (2021) analysis of South Africa's institutions agrees that path dependence is prevalent in South Africa, where institutions from the past continue to exert influence on the current and future functioning of the skills ecosystem. This systems inertia limits the climate responsiveness of the extension occupation, given the persistence of colonial legacies.

These findings highlight a disconnect between theoretical occupational classification frameworks and their practical utility. The findings indicate the need for verticalities to be more responsive and facilitating to skills planning and development. To achieve this, there is a need for a more broader and more flexible unit of intervention for skills planning and skills development. The existing occupational structures appear incongruent with African realities and the challenges posed by climate change, underscoring the need for a more tailored skills planning approach that aligns with the contextual realities and ecological needs of the agricultural sector.

7.4.3 Agricultural extension and VET policy responsiveness to climate change

Objective 4, outlined in Chapter 1, section 1.3, aims to review the responsiveness of VET and extension policy and labour market data to climate resilience. The subsequent discussion brings to light Chapters 5 and 6 findings, particularly on the policies' emphasis and orientation in climate change within the skills ecosystem.

Facilitating verticalities in form of policy directives in both South Africa and Uganda demonstrate the willingness and an intention to integrate climate resilience into the VET formal education system, especially in extension education.

In both countries, most development policies on agriculture and climate push VET institutions towards multidisciplinary approaches as findings show in Chapter 5, section 5.6.3 and Chapter 6, section 6.7.3, to develop climate resilience skills and mainstream this expertise into the study curriculum. However, VET policies are silent about the development policy recommendations on climate resilience and Uganda's VET policy lacks reference to climate change. These contradictions are further confirmed through the curriculum review findings which indicate a gap between policy aspirations and actual implementation.

In Alice, findings in Chapter 5, section 5.5.3.3, indicate that the process of reviewing and updating the curriculum at FCAFTI is complex and heavily influenced by enabling verticalities that occupational professional bodies like the South African Society of Agricultural Extension (SASAE), the Department of Higher Education and Training (DHET) and Council for Higher Education (CHE) that have an input in the curriculum review and approval processes. Due to the lengthy review and approval process of the curriculum, the institutional bureaucracy, as findings revealed, limits swift updating of the FCAFTI curriculum to would integrate climate resilience expertise. The findings may suggest that these verticalities are not facilitating enough to VET institutions like FCAFTI to integrate policy priorities and recommendations on climate resilience into the extension study curriculum.

In South Africa, analysis of historical literature highlights a positive trajectory in transition of policy priorities on climate change since independence. Analysis showed that most development policies on agriculture developed soon after independence were primarily concerned with issues of land reform and redistribution, commercialisation of agriculture, and market-based orientation for poverty alleviation, as scholars like Ngam (2021) noted in Chapter 5, section 5.2.2. There is a departure from this orientation demonstrating current development policy environment on agriculture and climate mainstreaming sustainability issues in South Africa to even impact the most vulnerable. This is highlighted in 2030 National Development Plan (National Planning Commission, 2012) suggesting building resilience for the most vulnerable in the society. The 2022 Agricultural Sector Skills Plan (AgriSETA, 2022) and the Framework for a Just Transition (Presidential Climate Commission, 2022), further emphasise this need of skilling and reskilling vulnerable groups for climate resilience especially smallholder farmers. These findings hold significance as they align with research indicating the importance of recognising informal groups at a family and community levels within the skills ecosystem. Doing so is crucial for addressing social inequalities and ensuring equitable outcomes in skills provisioning, development and utilisation, as highlighted by Brown (2022).

This change in policy orientation contrasts with the historically contradictory policies crafted around the time of independence as they grappled with balancing developing environmentally sound extension approaches and improving social and economic welfare.

Like South Africa, a progressive shift in policy orientation towards climate resilience is observed in Uganda's climate and extension policy, but this is evidently absent from the TVET policy. This too has historical roots as Mamdani (1996) highlighted that going back to the

1920s, Uganda's agricultural policy and extension education was export-led predominantly emphasised increasing agricultural output and less on sustainability in agriculture. This finding aligns with Raile et al.'s (2021) earlier findings, which stress that Uganda has traditionally grappled with an inefficient agricultural extension system with no unified local social systems, limiting their adaptability to climate-induced agricultural challenges, such as adopting climate-smart agriculture practices.

However, the contemporary extension and climate policy stance has pivoted to promoting climate-resilient technologies and innovations, as evidenced in National Agricultural Extension Strategy (NAES) (Ministry of Agriculture, Animal Industry and Fisheries, 2016). This evolution in extension policy direction deviates from historical extension models that were primarily focused on the broad uptake of technologies without adequately addressing environmental sustainability as earlier shown in Chapter 6, section 6.7.3.1. Furthermore, supporting the critique of older policies, scholars like Rivera and Sulaiman (2009) and Nkonya et al. (2020) have indicated that these strategies, though advocating innovation adoption, leaned more towards theoretical propositions than practical implementations.

Concerning VET skills development, facilitating verticalities in form of policy influence curriculum development at Gulu University, as evidenced by the connection between the university's curriculum review processes and the broader national development policies as highlighted in Chapter 6, section 6.6.3.2. Nevertheless, contradictions between policy design and execution still exist. From interviews, extension officers pinpointed a contradiction between policy development and its subsequent deployment, indicating a potential misalignment between policy directives and the labour market's needs. As revealed in the findings, the labour market seems to undervalue the importance of climate expertise in extension work, which can be inferred from the job listings analysed in Chapter 6, section 6.7.1.

These observations carry substantial implications for the broader skills ecosystem. Despite the policy's explicit willingness for climate resilience, the labour market's disregard for these skills might suggest that verticalities are not adequately facilitating in the labour market which has implications for VET mediation in the skills ecosystem for climate resilience skills planning and development. This gap, however, underscores systemic contradictions: the curriculum appears more industry-tailored, and the labour market's seeming indifference towards climate resilience might continue to hamper collective efforts for climate resilience within the skills ecosystem. This is further complicated by the varying, sometimes conflicting, interests of the

system's stakeholders, as seen in Figure 7.3. The temporality of activity systems by new changes in climate is bringing the contradictions to the skills ecosystems. The development policy and agricultural policy indicate the need for climate resilience, but this is not being acknowledged and actioned by the skills systems and thus, the skills ecosystem is not adequately responsive to climate resilience. This is also evident in Gulu case as well.

Overall observations in both cases indicate the significance of national-level facilitating verticalities, as highlighted by Spours (2021), which dictate regulations for training and education within the skills ecosystem. As Hodgson and Spours (2016) noted, these facilitating institutions in a skills ecosystem play an instrumental role in shaping learning environments, providing necessary infrastructure, financial aid, and regulations. The limited incorporation of policies in the VET curriculum in Alice might suggest bounded mediation which weakens the mediating role of VET institutions in the skills ecosystem and the potential contradictions introduced by dominant vertical activity system actors like the DHET and CHE responsible for curriculum oversight.

Finally, the contradictions in activity systems also hint at weak and outdated mediating tools in form of study curriculum especially at FCAFTI and suggest that the historical structures informing today's skills planning might hamper swift adaptation to climate resilience expertise.

7.5 Visualising the skills ecosystem for Alice and Gulu

This study has discussed understandings of the extension officer occupation. The extension officer occupation has evolved and is the focal point of planning and developing skills required to support smallholder farmers, who are the majority in South Africa and Uganda. This section showcases how the skills ecosystems for South Africa and Uganda were conceptualised in this thesis to show the multiple actors, activity systems and forces prevalent in the skills ecosystem and how these are mediated to develop skills for work and livelihoods in the face of changing climate and where contradictions exist that hamper facilitating verticalities, mediating institution's roles and horizontal connectivities.

These insights from the findings culminate in Figures 7.2 and 7.3, which provide a graphic representation of the interplay of various elements and activities within the skills ecosystem, set against the backdrop of CHAT, which theorised the mediation space of the SEM for skills.

These figures vividly illustrate the climate resilience activities taking place within the skills ecosystems of Alice and Gulu. In these depictions, the activity systems (whether vertical, horizontal, or mediating) converge at a central mediation space of the skills ecosystem. Here, they collaboratively work towards a shared object, encapsulated by a dotted circle, representing climate resilience. The curriculum, integral to this synergy, emerges as the pivotal mediation tool for VET that shapes skills development in training institutions, residing within the mediation space of the SEM for skills as mediators in the skills development relationship.

The evolution from the earlier SEM-CHAT model (as shown in Chapter 3, Figure 3.10) to the current conceptualisation exemplifies the shift in the study's trajectory.

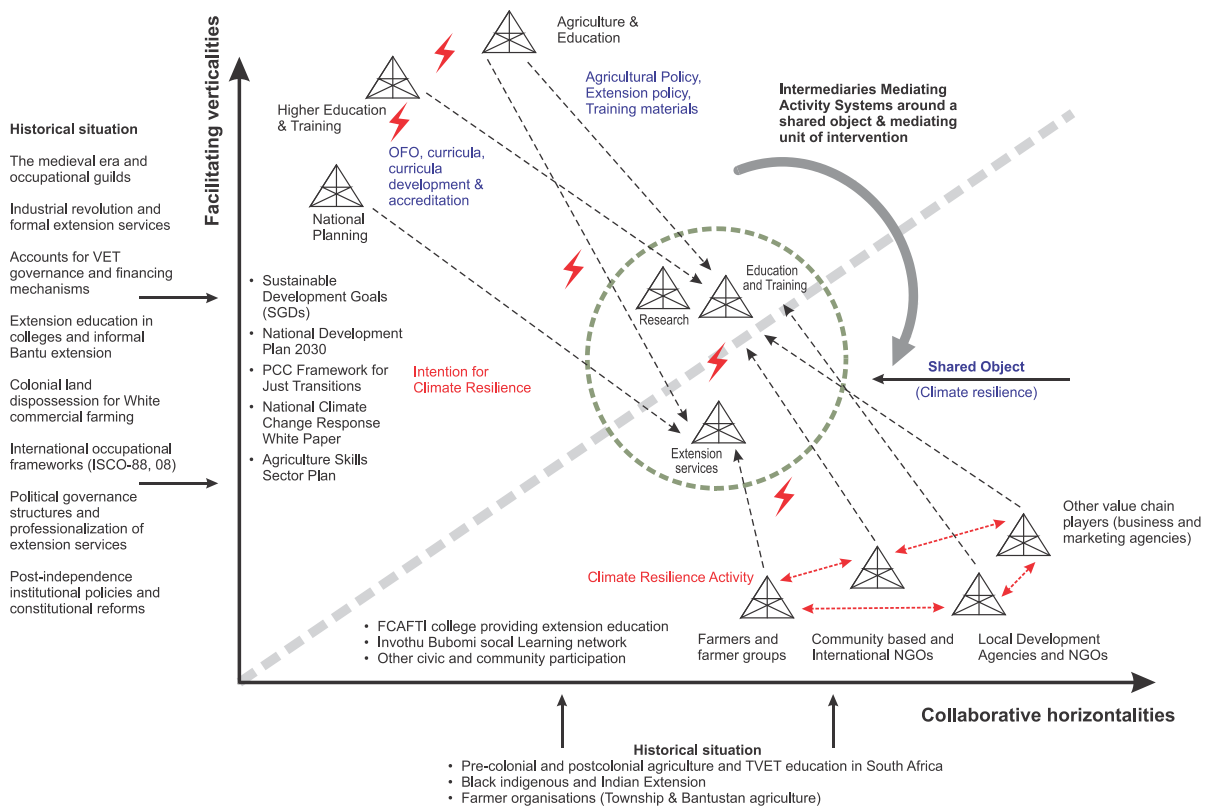


Figure 7.2: Social Skills Ecosystem for Alice
Source: Author

The depiction in Figure 7.2 represents a comprehensive illustration of South Africa's skills ecosystem to show the complex interplay of components in this skills ecosystem.

Activity systems and actors: These form the core of the skills ecosystem. The activity systems are present at the vertical and horizontal and mediation spaces of the skills ecosystem. These activity systems embed within them are multiple actors involved in extension work, living and learning actively involved in the transformation process of climate resilience. Findings from Alice show that activity systems at the vertical dimension dominate those at the horizontal and

mediation space and bind the mediation actors within these activity systems as earlier highlighted in this chapter (section 7.4.1).

Horizontal dimension: This dimension comprises activity systems with multiple actors. The activity systems identified include farmers and farmer groups, local development agencies and NGOs working in agriculture, and other value chain actors who include businesses and marketing entities working closely with farmers in Alice. The short arrows on this horizontal dimension signify interactions and collaborations among these entities, all converging towards a common objective of building resilience to climate change. Findings in Chapter 5, section 5.5.4, show that actors in horizontal activity systems are breaking away from the restrictive rules produced by enabling verticalities in vertical activity systems to act on climate change through social learning networks, mainly Imvothu Bubomi Learning network, in collaboration with mediating institutions and extension officers. The findings on the presence of actor collaborations and social learning on rainwater harvesting and agroecological practices in Alice are affirmed in Lotz-Sisitka et al. (2018), Lotz-Sisitka and Pesanayi (2020) and Chanyau and Rosenberg (2023).

Mediating activity systems: Situated centrally within the skills ecosystem, these activity systems bring together the vertical and horizontal dimensions into meaningful collaboration. The findings revealed the mediation sphere primarily comprises Education and Training, Research, and Extension Services that facilitate the confluence of different actors from these activity systems to promote synergies on climate resilience learning for work, living, and learning (Spours, 2021). The findings indicate that vertical facilitating activity systems continue to exert dominance and constraints on mediating and collaborative horizontalities through rules and regulations, influencing the mediation processes and the role of mediating actors, and consequently shaping the overall responsiveness of the skills ecosystem to the challenges posed by climate change in agriculture. These findings are specifically discussed in Chapter 5, section 5.5, concerning the curriculum review process, which is governed by education and agricultural government institutions situated in vertical activity system.

Connections and interactions: The illustration prominently depicts nuanced connections within the system. Notably, there is a discernible but indirect link between national planning and higher education and training, which is responsible for development policy and training policy formulation, and extension services. Findings show that the intermediary in this relationship is the education and training activity system where actors like universities and agricultural college

are providing learning for extension officers and farmers on climate resilience through Imvothu Bubomi social learning network. While the connection is not direct, the vertical activity systems, represented by higher education and training, exert influence over extension services, shaping the latter's role in mediating climate resilience expertise for farmers. The extended arrows highlight the connections that extension services maintain with actors in the agricultural education activity system, including entities like AgriSETA and the Department of Agriculture.

Facilitating rule-producing activity systems: Emerging from the vertical dimension, these arrows converge on the central mediation space. The vertical activity systems include institutions that produce policy frameworks, training frameworks, and tools that govern the skills ecosystem. The findings highlight the influential role of occupational classification frameworks such as the OFO, curriculum development guidelines, and policies in shaping the skills ecosystem and extension training. Chapter 5, section 5.6.2 findings indicate that the Department of Higher Education and Training is responsible for the development and updates of the OFO.

Historical forces and contradictions: Serving as a backdrop, the forces and factors that have historically influenced the present-day skills ecosystem are represented behind the vertical and horizontal axes. These forces, which have been pivotal in shaping the current dynamics, are depicted outside the core structure of the ecosystem with arrows. Findings derived from historical analysis have illuminated that several facilitating institutions within vertical activity systems, such as DHET and CHE, remain entrenched in historical contexts, posing constraints on FCAFTI's ability to review and update its extension curriculum for climate resilience expertise. The examination of development policies related to climate, agriculture, and VET uncovers contradictions originating from vertical activity systems, characterised by conflicting focuses and conflicting priorities. For instance, while the development policy addressing climate change and agriculture recommends the integration of climate resilience skills into agricultural formal and non-formal training curricula, VET policies on training barely mention climate change or extension services (refer to Chapter 5, section 5.6.3). These contradictions among various activity systems are symbolised in Figure 7.2 by lightning symbols. Engeström's (1987) assertion holds that contradictions arise from deep structural tensions that influence the multitude of actors and manifest in conflicting interests and priorities. As mentioned in Chapter 3, they also represent leverage points for expansive learning and therefore for improving mediation processes in the SEM for skills.

Overall, this complex depiction paints a holistic picture of South Africa’s skills ecosystem, detailing how historical influences, contemporary policies, and diverse actors converge to shape the country’s approach to climate resilience skills development or how they impede this in the face of changing climate. The main contradictions that need engaging moving forward are mainly between development and VET policies, development policy and labour market, development policy and extension, and extension and labour market.

Figure 7.3 below indicates the conceptualisation of Gulu’s skills ecosystems from this study’s findings.

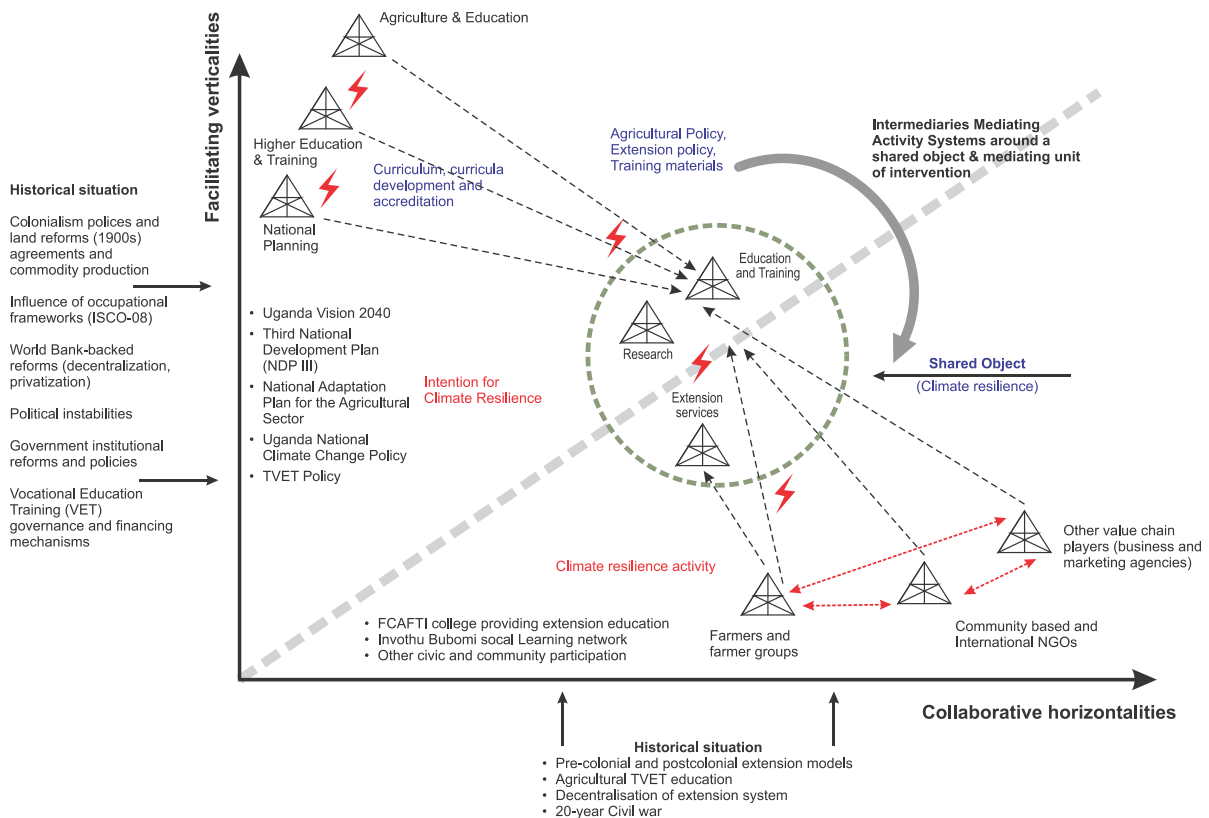


Figure 7.3: Social Skills Ecosystem for Gulu
Source: Author

The Gulu skills ecosystem diagram also illustrates how multiple activity systems come together to address the pressing need for skills development in the face of climate change. Key features of the Gulu skills ecosystem include:

Horizontal dimension: Activity systems in this dimension comprise actors like farmers, NGOs, input suppliers, and other significant players in the value chain like marketing entities and produce buyers. These players are crucial to Gulu’s agricultural ecosystem. The short arrows connecting activity systems demonstrate their interactions and highlight how these activity

systems function synergistically, aiming towards enhancing climate resilience or at times impeding this process. Findings show that there is a harmonious collaboration among horizontal connectivities and this is exemplified by their input to the curricula update and review for Gulu University as interviews indicate in Chapter 6, section 6.6.3.

Historicity: The influences of the past are prevalent. The historical context, depicted behind the vertical and horizontal axes with arrows, indicates the influence of history (local, national and global) on the evolution of the skills ecosystem. On the horizontal dimension in Figure 7.3, the history of Gulu is overshadowed by disruptive civil unrest, that hindered the development of extension services. In the post-conflict era, extension services are still in their nascent stages of re-emergence. These findings are corroborated by Lotz-Sisitka et al. (2023) and Branch (2013), illustrating that Gulu's disruptive historical past has set back the region in terms of social and economic development. These setbacks have had repercussions for climate resilience skills development, particularly in the realm of extension support to farmers, as highlighted by extension officers in Chapter 6, section 6.6.4. On the vertical side, findings showed the World Bank-backed reforms disrupted the country's extension system due to fronting of privatisation and decentralisation as well as restricted funding (see Chapter 6, section 6.2.7).

Vertical activity systems: Operating from a top-down approach, these systems play a foundational role in shaping the central ethos of the skills ecosystem. Their positioning emphasises their importance in creating rules, frameworks, and guidelines for the core extension services and the broader skills ecosystem. In particular, the alignment of the development policy and curriculum development signifies an integrated effort towards promoting climate resilience. Findings from Chapter 6, section 6.6.3 reveal that Gulu University consults policies produced in vertical activity systems by actors such as the Department of Education and Sports, National Council for Higher Education (NCHE) and Directorate of Extension Services, such as the Sustainable Development Goals, Africa Agenda 2063, and the Third National Development Plan, to inform the review and update of the curriculum for extension services with climate resilience. The guidelines provided by the NCHE for curriculum review afford the university flexibility in this process, enabling the integration of climate resilience into the study programme.

Contradictions in the skills ecosystem: The lightning symbols depict the contradictions apparent within the skills ecosystem as various activity systems and their embedded multiple

actors interact. Findings indicate contradictions between the development policy on agriculture and climate change and labour market where recommendations of the policy are not adopted by recruiting government and private organisation recruiting extension offices as indicated in Chapter 6, section 6.7.1. Extension officers also indicate limited capacity building opportunities for developing climate resilience expertise, hampering their ability to effectively support smallholder farmers with adaptive capacities in climate change (refer to Chapter 6, section 6.6.4). These contradictions also point to key leverage points for improving mediation in the SEM for skills.

7.6 Re-imagining social ecosystem for skills mediating unit of intervention

In light of the insights from objectives 1-4, this section addresses the fifth objective, which seeks to envision a new mediating unit of intervention for skills planning that has implications skills development relevant to climate resilience in agricultural extension, if needed. Drawing from empirical findings and relevant literature, this thesis proposes that occupation as mediating tool for skills planning be extended through use of workstreams conceptualised within the SEM-CHAT framework.

The findings have clearly shown that occupations are universally the primary mediating unit of intervention for skill planning and skills development, including in South Africa and Uganda. The findings have also underscored the inherent inflexibility and inability of the current occupational structuring to adapt to evolving labour market skills needs and anticipated future skills demands posed by the changing climate in the agricultural sector. This rigidity is especially pronounced in the context of the extension officer occupation, which was the central focus of this study.

Against this background, this thesis proposes workstream mapping as a potential mediating tool that can extend occupational framing limitations, for climate resilience skills planning and skills development for VET within the skills ecosystem.

As explained in Chapter 1, section 1.6, a workstream borrows from bodies of knowledge from related and unrelated occupations, diverse academic disciplines, and formal and informal knowledge backgrounds. Figure 7.4 below shows a workstream mapping tool, which includes multiple workstreams mapped based on the extension officers and farmers' skills needs, current offerings of the labour market, and occupational knowledge prevalent in related and diverse

occupations analysed from occupational classification frameworks. Extension occupation is extended into more complex workstreams but these need to be supported by activity systems in SEM for skills for extension officers to build climate resilience skills and adequately respond to climate change challenges.

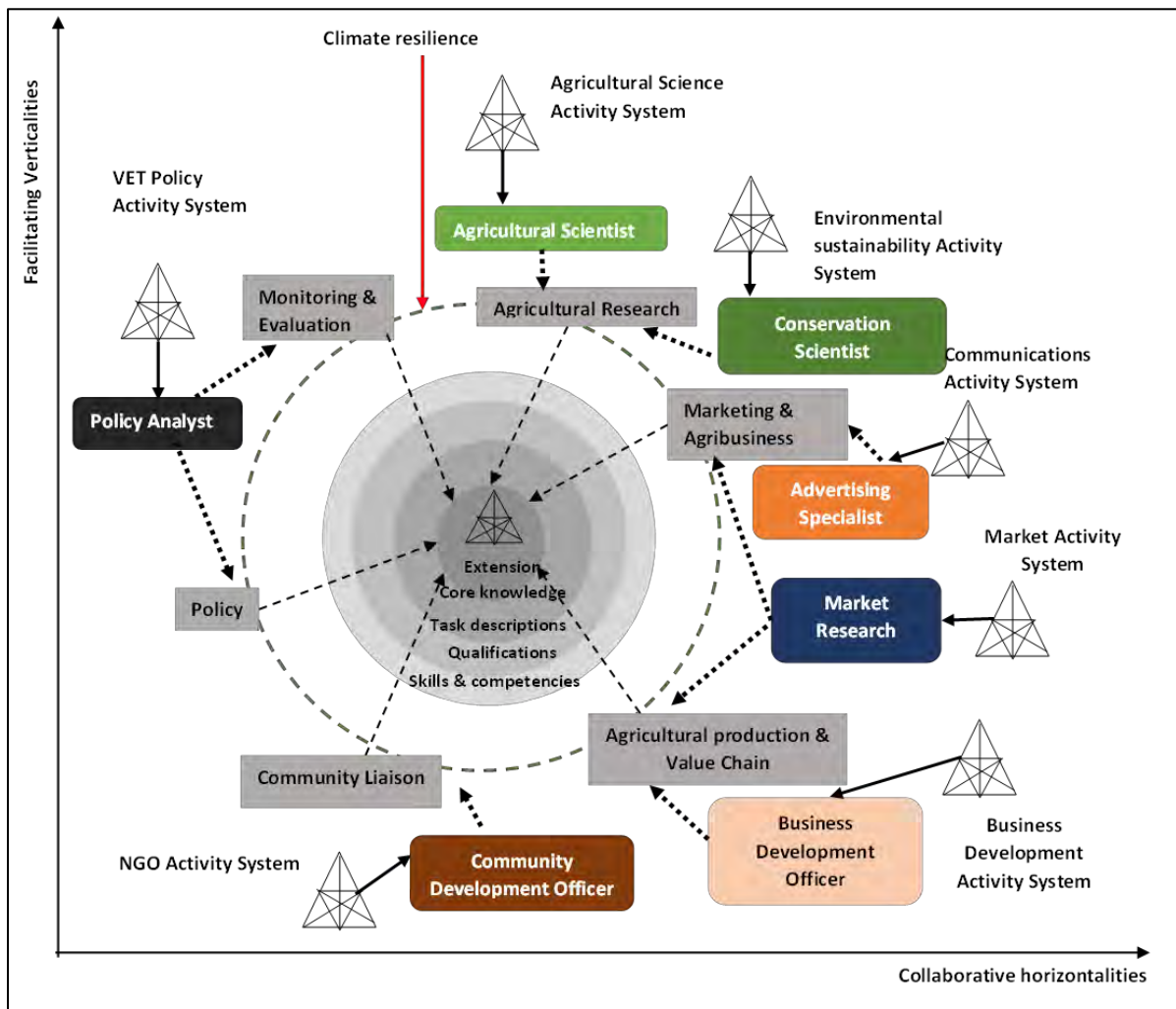


Figure 7.4: Workstream mapping for climate resilience skills planning and skills development in agricultural extension, with supporting activity systems contributing to the core knowledge of the extension occupation
Source: Author

Figure 7.4 elucidates that the fundamental knowledge indispensable for executing agricultural extension work tasks is at the heart of the ‘onion’ structure. Surrounding this core are concentric circles denoting varying degrees of significance attached to task descriptions, academic qualifications, skills, and competencies based on labour market analysis findings. This distinction departs from what is presented in Figure 7.1 (refer to section 7.5.1). An essential inference is that while qualifications are critical, they are not the only focus of extension work. Academic credentials were found to influence vertical career advancements from entry-level

to senior roles, but it is the intrinsic knowledge that is essential to extension work gained through ongoing mediated support in the skills ecosystem. The 'workstream' manifests as a more adaptable and encompassing mediating unit of intervention for VET skills development within the skills ecosystem compared to the rigid and historically situated occupational structuring that is not adequately adaptable to emerging climate complexities in the agricultural sector. To be more adaptively supported, there is a need to engage contradictions that hamper the functioning of the skills ecosystem as discussed earlier in this chapter and the previous Chapters 5 and 6. Occupations, by nature, can be restrictive, highly specialised, and resonate with the more stringent frameworks evident in the vertical activity systems depicted in Figures 7.2 and 7.3. Encircling the entire structure is the domain of climate resilience, a collective ambition all activity systems converge upon to transform. Within this realm, myriad activity systems, each endowed with distinct expertise and skills, collaborate, infusing a spectrum of knowledge into the workstreams (within grey boxes) to enrich the core knowledge required for extension work. When used as a mediating unit of intervention for skills planning and skills development within VET, the workstream mapping approach supported by different activity systems in the skills ecosystem promotes interdisciplinary and transdisciplinary approaches, transcending conventional knowledge boundaries enhancing climate resilience. Transitioning from rigid occupational paradigms to using workstream mapping and mediating activity systems in skills ecosystem offers VET more flexible tools to plan and develop extension skills essential for addressing climate challenges and meeting other evolving agricultural extension needs.

7.7 Conclusion

This chapter discussed the findings outlined in Chapters 5 and 6, setting the stage for a potential expanded mediating unit of intervention for VET skills planning and development in agricultural extension. This thesis uncovered significant revelations: The occupational discourse and occupational structures are deeply embedded in historical traditions, tracing back to the medieval era, and maintain remnants of old practices, notably through licensing, certifications, and other occupational entry limitations. The extension officer occupation, first established by colonial administrations, proliferated across Africa, structuring skills planning systems for extension services.

The analysis from the chapter shows distinctive characteristics of the extension officer occupation in Africa that is decentralised and pluralistic with both public and private entities

playing pivotal roles which reflect as activity systems in a skills ecosystem. It became evident that there is a trend in the professionalisation of this occupation across the continent, marked by the increasing adoption of accreditation and specific extension qualifications. Unfortunately, most extension systems in African countries operate on interim policies rather than legislated ones. A salient point of concern is the VET curricula in Alice and Gulu. Particularly for Alice, the curriculum lacks the responsiveness to adequately address climate resilience through extension education and training. Rectifying this demands a comprehensive review and reformation of the curriculum, which requires proactive engagement from stakeholders in the vertical activity systems of the skills ecosystem. Besides the curricula's inertia, the current situation reveals a gap in the knowledge and skills of extension officers of climate resilience, exacerbated by the labour market's inactivity towards embracing climate resilience, as indicated by the inflexibility in job listings and occupational classification frameworks. Historical underpinnings seem to hold these structures in place, rendering them ineffectual in the face of present and future climate change challenges, and producing contradictions in the SEM for skills between vertical, mediating and horizontal activity systems. Although climate and extension policies indicate a tilt towards climate resilience (with Uganda's VET policy being a notable exception), their practical implementation in education and the workplace remains unattained.

In summary the traditional occupational models, such as that of the extension, are ensnared in a rigid historical system and are falling short in confronting the challenges ushered in by climate change in agriculture. The insights gathered in this thesis have shown that the constitution of the agricultural extension officer occupation as a mediating unit of intervention for VET skills planning and has implications for skills development is inadequate for climate resilience, hence answering the main research question. To this end, this thesis suggests the adoption of workstream mapping in activity systems in SEM for skills as a promising avenue for expanding planning for current and future skills and contemporary skills development in VET, potentially ensuring a more responsive approach to evolving skills needs in our contemporary skills ecosystem. However, to attain this, there is a need to engage the contradictions present in the skills ecosystem to effectively harmonise the actor collaboration for work, living and learning.

CHAPTER 8: CONCLUSION AND RECOMMENDATIONS

8.0 Introduction

Chapter 8 offers a conclusion and recommendations from the study. It commences with a succinct research recap, encompassing its objectives, methodology, and primary insights. The chapter further reviews the theoretical framework's usefulness in guiding the research. The research's distinct contributions are highlighted, emphasising its key insights and the gaps it has bridged. The chapter culminates in practical, policy, and future research recommendations, each deeply rooted in the study's findings. The chapter also acknowledges the study's constraints and challenges to provide a holistic view of the research journey. Finally, an overview of the chapter offers summary of its content and potential significance in the broader academic discourse.

8.1 Summary of the research

This qualitative study was a cross-case between Alice in South Africa and Gulu in Uganda. The study aimed to examine the adequacy of an occupation as a mediating unit for climate resilience skills planning and skills development, focusing on the agricultural extension officer occupation.

The study also answered the primary research question: What is the theoretical and practical history and current constitution of the agricultural extension officer occupation as a mediating unit of intervention for VET skills planning, and is it adequate for climate resilience?

The study's broad aim was formulated into five specific objectives outlined in Chapter 1, section 1.3, which were to:

- 1) To conduct a historical review of occupation as a mediating unit of intervention for skills planning and skills development
- 2) To examine current descriptions of the extension occupation in Africa
- 3) To examine how VET preparation for extension work takes place in response to the need for climate resilience through a curriculum review and the experiences and related work activities of extension services actors.

- 4) To review agricultural extension, VET policy, and labour market data for its responsiveness to climate resilience.
- 5) In response to the findings of Objectives 1-4 offer expanded possibilities for a mediating unit of intervention for skills planning and skills development relevant to climate resilience in agricultural extension, if needed.

Chapter 2 of the study set the scene for this thesis by reviewing the literature on occupation as a mediating unit for skills planning and skills development by conducting a historical sociology of occupations and further uncovering how the occupational discourse was transferred to the African skills planning systems. The chapter then explored the history of extension occupation in Africa and discussed this more broadly in terms of its nature and configuration in response to the skills needs of the agricultural sector and farmers.

In Chapter 3, the study described the theoretical underpinning of this research. The study employed an overarching Social Ecosystems Model for skills theoretical framework and situated CHAT into this framework to theorise mediation and jointly provide this research with a robust theoretical framework. This overarching framework also gave the study robust epistemological and ontological assumptions under which knowledge of the study subject could be created and reality understood.

Chapter 4 of this thesis described the methodology employed in this research. Concisely, this study employed a qualitative methodology and a cross-case design to study the research phenomena in Alice and Gulu. The methods employed encompassed primary and secondary approaches, including reviewing scholarly literature and analysing secondary documents and primary data through interviews with study participants. The tools applied for data generation included a Climate Resilience Assessment Tool and a semi-structured interview schedule. Overall, 46 participants were involved in the study at various stages through personal and focus group interviews and curricula review using the Climate Resilience Assessment Tool. The study participants include extension officers, final-year extension students, extension lecturers, and smallholder farmers.

8.2 Summary of findings

Findings affirm that currently occupations serve as primary units of intervention for skills planning and further reveal that the occupations have historically evolved with features reminiscent of the medieval occupational guilds. The occupational features mirror these guild systems, influencing contemporary occupation structuring and classification systems. This occupational discourse was introduced in African skills systems during colonial times, previously focusing on communal farming, and discourse proliferated within the African countries with the introduction of other colonialism occupations like clerks and interpreters; eventually, African nations adopted them for skills planning and they have since been used in labour markets, making academic and career choices and designing qualifications and study curricula.

The findings reveal that the configuration of the extension occupation exhibits varied features. First, the extension occupation in Africa primarily supports smallholder farmers, notably women, emphasising their significance in agriculture. Secondly, historically, there has been a transition from a government-led to a decentralised pluralistic extension approach, prompted by World Bank reforms like privatisation and decentralisation. Thirdly, most African nations use interim extension policies, focusing more on agricultural profit, often overlooking climate resilience. Specifically, South Africa's policies have fluctuated since post-independence as they sought focus, while Uganda, whose policy has also evolved, currently has a legislated policy unlike South Africa. Fourthly, extension occupation professionalisation in Africa is gaining momentum. South Africa, for instance, has a structured regulatory framework for extension professionalisation, unlike Uganda's decentralised system where employers determine prerequisites. Finally, extensions face climate-induced challenges in most African countries, emphasising the need for robust extension services and climate expertise.

Concerning how VET prepares for extension work and related experience and activities of extension actors, the research findings indicate that the VET preparation for extension work, especially in Alice, does not sufficiently address climate resilience. In Alice, a review of the Diploma in Agriculture curriculum at FCAFTI revealed a need for better integration of climate resilience in study content, research, innovation, community engagement, and teaching methods. On the other hand, while Gulu's Bachelor of Science in Agriculture curriculum appears more responsive to climate resilience, there is room for improvement in areas like research and innovation for climate resilience and enhancing students' skills in climate

communication. Feedback from extension officers in both Alice and Gulu underscores a prevailing deficiency in climate resilience expertise and a lack of adequate training opportunities to cultivate this essential knowledge, calling for transformative mediation.

The labour markets analysis revealed that in Uganda and South Africa, labour markets do not adequately prioritise climate resilience. According to the reviewed job adverts, the entry requirements for extension occupation in both countries sideline expertise and skills in climate resilience. In addition, academic qualifications were the primary requirements determining entry and progression in the labour markets. Moreover, the prevailing occupational frameworks are rigid and still heavily rooted in colonial-era structures, hindering the effective integration of climate resilience. An analysis of extension and VET policy found an inclination of VET to integrate climate resilience in South Africa; in Uganda's case, climate change is glaringly missing in VET policy. However, extension policies across both nations acknowledge the severe implications of climate change on agriculture and the economy, significantly affecting vulnerable groups. There is a noticeable policy push to embed climate resilience in both extension services and VET training programmes, but as yet there are inadequate policy instruments and/or mediation processes to enable facilitating verticalities in the SEM for skills oriented towards climate resilience.

8.3 Usefulness of the theoretical framework to the study

The theoretical foundation of this study relies on the combined strength of the Social Ecosystems Model (SEM) for skills and Cultural-Historical Activity Theory (CHAT). SEM for skills provides a broad structure to identify mediators and actors in extension work and learning, and it offers a strong focus on mediation. However there is a need for a focused lens to uncover the complex details of activities within this model, which was offered by CHAT, deepening. CHAT helped to deepen and foreground cultural historicity, theorise mediation and it also helped in conceptualising the SEM for skills as a multi-layered construct of activity systems. This also enabled a surfacing of contradictions' influence especially the mediating institutions' roles, and opening up insight into where advances can be made for strengthening mediation in the SEM for skills in both case contexts. While similarities existed in the types of contradictions, the cases also showed that there are specificities in each case need to be properly understood if the contradictions are to be resolved.

CHAT offered useful lenses for theorising the mediation space within the SEM for skills. It elucidates how the skills ecosystem functions as an intertwined network of activity systems

focused on fostering climate resilience. The role of the extension occupation as a mediator is mainly highlighted, acting as a conceptual tool in the skills ecosystem that steers skills planning and development. VET study curricula, in contrast, are tangible tools used in training for extension, useful in the mediation process.

The combined SEM-CHAT framework illuminates the diverse actors playing roles across various dimensions of the skills ecosystem. CHAT highlights how different entities at vertical levels, from international to local, govern the ecosystem, enacting policies and formulating frameworks. In contrast, the horizontal dimension encompasses local actors operating within these larger governing structures. CHAT also underscores these actors' multiplicity of perspectives (or multi-voicedness) which informed the various dynamics of the extension workstream mapping approach conceptualisation.

These varying activity systems and their rules can sometimes result in contradictions within the skills ecosystem, which could ultimately block or enable transformative change. The contradictions identified involved policy contradictions between development policy on agriculture and climate change and VET skills development as well as policy and labour market requirements. Other contradictions involved the extension activity system bounded by the rules produced by the vertical activity system that constrain its responsive to farmers despite the need to respond to its primary clientele: smallholder farmer needs for climate resilience adaptive skills.

By integrating the ecological time of the SEM for skills with CHAT's emphasis on historicity, the study acknowledged the deep-rooted, historically embedded nature of the structures and institutions in focus. Recognising this historical context enriched the analysis, particularly when investigating the history of occupations and extension services. Ecological and cultural-historicity also helped to identify a temporality mismatch between cultural historicity of occupational discourse shaping skills development, and the temporal demands of climate resilience.

Methodologically, SEM and CHAT offered the study a philosophical stance that sees humans as inextricably linked with their environments. Both theories are invested in understanding the symbiotic relationship between humans and their surroundings, thus offering a holistic perspective on the skills ecosystem, offering a social-ecological perspective on the SEM for skills.

8.4 Contribution of research to new knowledge

This research has contributed to academic discourse by introducing an approach to planning for future skills and developing the contemporary skills required in agricultural extension for climate resilience. Recognising the entrenched rigidity and historical situatedness of existing occupational configurations, which appear to be ill-equipped to meet the evolving demands of climate resilience, the study underscores the urgent need for a departure from the traditional. At the heart of this research is the SEM for skills approach that opened up the possibility of articulating a workstream approach to skills planning that has implications for skills development involving multiple activity systems in a skills ecosystem. Unlike conventional systems, this approach does not adhere strictly to job roles or occupational boundaries. Instead, it adopts a flexible and dynamic model, mapping skills and knowledge areas across various domains pertinent to agricultural extension and embedding climate resilience, thus enriching the extension occupation, and offering more flexibility in relation to the demand for changing knowledge and skills in the context of building climate resilience.

Such an approach acknowledges the multifaceted nature of today's agricultural challenges. Climate change brings with it not only shifts in weather patterns but a myriad of socio-economic, ecological, and technological implications. Addressing these requires a holistic understanding beyond traditional occupational roles' confines. The workstream mapping approach provides a means to capture this comprehensive perspective, incorporating diverse sets of knowledge and skills from various activity systems, both formal and indigenous. By emphasising adaptability, the workstream mapping approach offers a potential tool that might be equipped to cater to evolving on-ground realities and needs in Africa's skills ecosystem.

This thesis proposition of the SEM, CHAT and workstream mapping approach calls for a paradigm shift in how we perceive and plan for VET skills development in agricultural extension, urging stakeholders to embrace a more inclusive, adaptive, and comprehensive approach that can also enable engagement with contradictions. This approach holds promise for VET to better equip extension officers and farmers with the skills they need and sets a precedent for other sectors to rethink and revamp their skills planning and development in the face of dynamic climate challenges.

This thesis has contributed to theory development by jointly utilising the SEM for skills and CHAT frameworks that have different theoretical orientations and backgrounds, with SEM emerging from cultural critique after Gramsci (Spours, 2022) and CHAT emerging from

cultural psychology's focus on mediation and expansive learning in workplaces, after Engeström (1987). Interestingly, both have roots in Marx's work which focussed on transforming society in relation to structural hegemonies (Gramsci's interest was cultural hegemony, which built on Marx's focus on class hegemony)¹⁴. The application of CHAT to theorise the SEM for skills within this study revealed that skills systems are intricately interconnected with historical contexts and influenced by many activity systems and actors with varying interests. This has significant implications for the tools and processes involved in mediating the planning and development of skills.

CHAT's historicity provided valuable analytical tools to examine the dynamics of skills ecosystems, including identifying contradictions arising from different activity systems such as policy from the verticalities, the historical roots of institutions across vertical, horizontal, and mediation spaces, and how this historical context can lead to inertia and path dependence. The theoretical framework also advanced SEM for skills by revealing insights into the SEM for skills related to ecological time. Here a mismatch between the cultural-historical time of occupational skills planning and skills development and the temporal demands for climate resilience was identified.

SEM for skills in its current form assumes that Time is linear. However, this study has shown the contradictions in policy emerge at different historical periods and in different contexts, and this draws attention to the importance of considering cultural-historical time (not necessarily linear) in the evolution of skills ecosystems. By recognising the significance of cultural-historical time, the study underscores the importance of incorporating a more nuanced understanding of temporal dynamics into the SEM for skills. This recognition allows for a deeper appreciation of how historical contexts and traditions influence current skills development initiatives, providing valuable insights for policymakers and practitioners seeking to navigate the complexities of planning and developing skills. Overall the use of SEM and CHAT in this thesis has advanced new insights for skills planning and development, and has laid the groundwork for future research to further explore and apply this framework in diverse contexts.

¹⁴ This dynamic of the theoretical framework was not pursued in this study, but is an interesting avenue to consider in future work that expands on the way in which SEM and CHAT theoretical tools are related and how they may differ. The study does show how the intersection of cultural and class hegemonies played into construction of the colonial legacy which as described in Chapter 2, have left Africa with skills planning tools that are misaligned with contemporary realities.

The next section offers recommendations emanating from the study.

8.5 Recommendations

8.5.1 Recommendations for practice: Addressing contradictions

In Alice, this study underscores the urgent need for the VET mediating activity systems to overhaul the Diploma in Agriculture curriculum, emphasising climate resilience across content, community outreach, research, and teaching methods. The revamped curriculum should balance theoretical and hands-on training on climate resilience, in addition to the essential aspects of the curriculum that reflect both the unique challenges faced by local farmers and national agricultural sector. This study suggests that to be effective in contemporary rapidly evolving work, the Diploma in Agriculture at FCAFTI qualification should encompass a broader range of knowledges and skills that are not strictly tied to a single extension officer occupation. This holistic approach can ensure that graduates are adeptly prepared to tackle the multifaceted challenges and execute varied tasks in the agriculture field of practice with proficiency of climate resilience.

In Alice, the education activity systems spearheaded by actors, mainly the DHET and the Council for Higher Education, should streamline the curriculum approval process, allowing VET agricultural colleges more adaptability in updating their curricula to better match evolving agricultural challenges, particularly climate change. Working with development policy activity systems will facilitate the incorporation of climate resilience policy recommendations in the study curriculum and materials, thereby equipping extension officers with essential climate knowledge. Moreover, the funding model should be restructured to grant colleges more autonomy in directing resources towards hands-on climate change learning experiences tailored to the local environment.

For Gulu University to bolster climate resilience research and innovation, this thesis suggests strengthening VET mediating activity systems to foreground climate change topics in the study programme's research projects for both staff and students. Staff incentives can include training, resource allocation, and networking opportunities with peers from other academic and research institutions and the private sector for collaborative climate-focused projects. The university's curriculum should also be refined to emphasise communication skills, equipping students with the tools needed to effectively gather, package, and share climate information through diverse mediums, including oral, written, and online platforms.

To enhance the preparedness of practising extension officers in Alice and Gulu against climate change-induced risks, it is imperative to prioritise non-formal training in climate resilience. Collaborations involving public entities, the private sector, local development agencies, and VET training institutions can craft learning platforms for extension officers. This place-based learning would ensure that they are well-equipped with skills and expertise relevant to the unique climate challenges of their respective areas.

8.5.2 Policy recommendations

8.6.2.1 Reimagining the role of extension officers

From a policy perspective, this thesis advocates redefining the role of extension officers considering climatic adversities. By embracing the workstream mapping approach as the mediating unit of intervention for climate resilience skills planning, there is a consequent necessity to redefine the role played by extension officers in assisting small-scale farmers, to be more flexible and embrace plurality. Such officers could spearhead research and innovations geared towards climate resilience, champion the diffusion of knowledge regarding sustainable farming amidst climate challenges, and centralise, synthesise, and disseminate pertinent climate data across diverse platforms and engage with multiple actors to benefit the agricultural community. Given the crucial role of agricultural extension and the challenges facing extension services in the face of climate change, there is a need to look forward and identify the skills required and how to develop them for sustainable food systems in SEM for skills across activity systems. The traditional understanding of occupations as narrow and highly specialised could potentially limit the holistic role of extension agents in today's dynamic and complex work environment, and their interaction with knowledge and skills that can be gained from other activity systems in the SEM for skills. This emphasises the importance of reconsidering or at least extending our conceptualisation of occupations, particularly when they function as the mediating unit for skills planning with implications for skills development in VET. Ensuring that extension agents are endowed with the necessary skills is fundamental to promoting rural development, securing food security, and mitigating poverty among smallholder farmers in Africa.

The role of the extension officers must evolve to address these emerging issues. In addition to their other pivotal functions, a reimagined role of extension officers in light of climate change is described below.

Climate educator: In addition to their current function on knowledge dissemination and information sharing, extension agents should be equipped with the latest knowledge on climate change and its impacts on local agriculture to bolster this function. This way, this function could involve disseminating relevant climate-related knowledge to farmers, enabling them to adopt best practices that mitigate climate risks. This would also involve working across multiple activity systems at all dimensions of SEM for skills such as the education and training activity system, NGO activity systems and indigenous knowledge activity systems to better facilitate social learning.

Innovator and researcher: The findings of this research and existing research showed an existing knowledge gap among extension officers in knowledge generation and documentation. This thesis suggests that extension officers should actively participate in field research, assessing the efficacy of new climate-resilient agricultural practices and technologies. In this way, they can provide evidence-based advice to farmers. This expertise should be introduced in their study curriculum too. By working closely with the research activity system, extension officer will build the capacity to research climate-smart innovations and further build their knowledge and skills in climate resilience, hence enabling them to provide adaptive capacities to smallholder farmers.

Community mobiliser and sustainability champion: Extension officers' role could involve mobilising communities for collective action against climate threats, promoting initiatives like community seed banks, shared water resources, or collective purchasing of climate-resilient technologies such as advanced irrigation systems. These issues emerged strongly among smallholder farmers in this research. Besides, extension officers should promote sustainable farming practices that not only combat climate-induced challenges but also reduce agriculture's carbon footprint, ensuring a sustainable food system for the future. As mediating actors in the skills ecosystem, extension officers can engage other actors at horizontal connectivities to build momentum and links for mobilising community for collective climate action. NGO activity systems, farmers' association activity systems and others like business activity systems would be pivotal in supporting extension officers' role in championing sustainability locally.

Policy advocates, skills system mediators and facilitators: This thesis has revealed that extension officers are disconnected from policy discussion in both Alice and Gulu. Future roles of extension officers should enable them to serve as a bridge between farmers and policymakers, communicating the ground realities and needs of the agricultural community to

those shaping climate and agricultural policies. In addition, given the pluralistic nature of extension delivery in Africa (and in both Alice and Gulu), extension officers should actively forge collaborations with actors in vertical activity systems like development policy, higher education, agriculture and education such as the Department of Agriculture, as well as collaborating with actors from horizontal activity systems such as NGOs and local development agencies and academic institutions. These networks can provide valuable resources, insights, and support for local agricultural challenges.

Climate data analyst: With the increasing availability of data-driven solutions, extension agents should be adept at interpreting climate models, rainfall predictions, and other relevant datasets, helping farmers make informed decisions based on predictive analytics. This could be essential for alleviating challenges related to planting season variations that smallholder farmers in both Alice and Gulu face. This could involve working closely with actors in the agricultural science activity system and the market activity system.

By integrating these functions in the broader role of extension agents, extension officers can become catalysts for change, steering agricultural communities towards a resilient future in the face of climate-induced challenges.

8.5.2.2 Policy interventions

Updating Uganda's TVET Policy: In Uganda, the Ministry of Education and Sports should revisit its Technical, Vocational and Training (TVET) policy. The goal should be to embed climate change considerations, providing clear directives to Technical Vocational Training institutions, agricultural colleges, and universities. This would ensure they incorporate climate resilience strategies and knowledge into their TVET curricula. By integrating climate change considerations and providing clear directives to the various educational institutions, the TVET curricula can be aligned to incorporate climate resilience strategies and knowledge. This adjustment in the education system would enable the future workforce, especially those in the agricultural sector including extension officers, to be better equipped with the necessary skills and knowledge to support agricultural community adapt to and mitigate the impacts of climate change, thus contributing to the resilience and sustainability of Uganda's agricultural sector.

Institute policy implementation and monitoring mechanisms: In both South Africa and Uganda, governments should establish mechanisms that mediate policy execution. Current findings highlight a noticeable disconnect between policy directives, the labour market, and place-based extension work activities. This misalignment persists even though policies emphasise the

importance of strengthening climate resilience in both extension work and VET extension training. Given that most policies are formulated with a top-down approach, the absence of mediating mechanisms often hinders the realisation of well-intended government policy directives. To address this, it is essential that implementation mechanisms foster collaboration among various entities within the skills ecosystem. These should be particularly those entities integral in the provision of extension services and with a crucial role in the agricultural value chain. Ensuring synergies and coordinated efforts among these stakeholders will facilitate the effective translation of policies into tangible actions on the ground, thereby enhancing the impact of such directives in achieving climate resilience and ultimately, the desired outcomes in the respective agricultural sectors.

Increasing public spending on climate resilience extension research and innovation: Both the Ugandan and South African governments should prioritise and boost funding for research and innovation in climate-resilient extension. This will empower key players in the agricultural sector and extension system to develop resilient climate technologies and cultivate crop varieties, like seeds, that can shield small-scale farmers from the adverse impacts of climate change. A study by Fan, Zhang, and Rao (2004) has provided empirical evidence supporting that public investments in agricultural extension, advisory services, and research yield the highest returns in terms of labour productivity. Given the increasing challenges posed by climate change, prioritising and enhancing funding for research and innovation in climate-resilient agricultural extension is imperative for agricultural sectors in both Uganda and South Africa. This would strengthen their agricultural sectors against the evolving climate challenges and to support the livelihoods of their farming communities.

8.5.3 Recommendations for further research

This section provides recommendations for further research based on the study findings described in this thesis.

This research introduces the workstream in a SEM and CHAT informed mapping approach as a mediating unit of intervention for skills planning that has overarching implications skills development within agricultural extension. It is recommended that further empirical testing be undertaken to validate and refine this approach.

Agriculture is pivotal for South Africa and Uganda's societal and economic fabric. Yet, this vital sector is threatened by the escalating threats posed by climate change. The call to action

is not only about adaptive techniques but it is important also to delve deeply into decolonising entrenched systems and practices that remain historically rooted and mainly unresponsive to contemporary climate adversities. This research has shed light on the prevailing rigidity of structures and institutional frameworks in South Africa and Uganda. However, further research is necessary to understand and instigate transformative mechanisms and mediating processes within these skills ecosystems. Through such in-depth investigations, a fair and sustainable policy and practice transition can be envisioned, ensuring resilient frameworks for work, living, and learning in the face of climate change.

The dynamic challenges posed by climate change necessitate the most vulnerable African countries develop robust mechanisms for forecasting and responding to evolving skills needs. The International Labour Organisation (2018) highlighted a pressing concern by pointing out the absence of systems or institutional mandates to identify present and impending skills requirements, encompassing both green and conventional jobs in Uganda. This research echoes this sentiment, underscoring the conspicuous gap in Uganda's labour market, which largely disregards the pressing need for climate resilience expertise among extension officers. As Uganda grapples with the multifaceted implications of climate change, conducting more studies to understand the country's current skill landscape and anticipate future demands, especially in sustainable agricultural practices, becomes indispensable. Through such thorough explorations, Uganda can chart a resilient and green-forward trajectory in its agricultural sector. In South Africa, more attention should be given to the smallholder farmer in skills planning and provisioning.

8.6 Study limitations

While this research has presented valuable insights, it has also faced certain limitations. One significant gap was the absence of insights from national, regional, or local policymakers in the pool of interviewees. Their perspectives would have enriched the understanding of overarching policy dynamics. In future research, it would be beneficial to incorporate policymakers as crucial respondents. Their insights and perspectives would enrich the data and provide a more nuanced understanding. In this way, future studies can bridge gaps in knowledge and offer a holistic view of the study phenomenon.

Methodologically, while the study leaned on the CHAT as one of its conceptual foundations, it did not fully embrace the formative intervention methodology, and did not fully explore the

potential of active co-engaged mediation within and between activity systems in response to the contradictions identified. This deviation might have influenced the depth of insights concerning place-based practices on climate resilience by farmers and extension agents and other stakeholders in respective case study sites, and further depth of insight into the contradictions and their manifestations in practice could also have been gleaned as can be seen from CHAT studies that work through expansive learning processes within and between activity systems in response to contradictions (e.g. Mukute, 2010; Pesanayi, 2019). The approach to skills planning can be enriched in future by formative intervention research specially to engage the contradictions identified. This is likely to add further insight into the mediation processes in the 45-degree space in the SEM for skills.

Additionally, the unprecedented challenges of the Covid-19 pandemic presented logistical constraints. The imposed restrictions limited face-to-face interactions with participants, especially in Alice, potentially diminishing the richness of participant interactions and depth of the engagement due to the impersonal nature of virtual communication.

Finally, because the focus was primarily on extension occupation and the structural occupational frameworks guiding them, the voices of the farmers were notably less pronounced in the findings. This untapped data would offer more depth in subsequent academic explorations beyond this study. Farmers voices would be particularly important in efforts to engage the contradictions found in the SEM for skills.

8.7 Chapter conclusion

This study aimed to examine the adequacy of occupation as a mediating unit of intervention for climate resilience skills planning, and associated implications for skills development, focusing on the agricultural extension officer occupation. The results underscore the deep-rooted nature of occupations, often anchored in historical and institutional traditions, making them less responsive in adapting to modern challenges of climate change. For instance, the agricultural extension occupation, primarily serving smallholders in Africa, operates mostly under provisional policies rather than formalised legislation. Moreover, these policies often emphasise agricultural productivity and profit-making. Nevertheless, an analysis of specific countries highlighted a policy shift towards climate resilience, especially within the VET for extension training. However, the practical application of these policies seems to falter, with a discernible gap between policy intent and practical implementation, hence the need for

improved tools for developing immediate skills needs and planning for future skills demand as proposed by this study. As shown in this study, the need for climate resilience is requiring temporal alignment between the cultural historicity of skills system planning tools and the temporality demands of addressing climate change. The two cases also show that regional SEMs for skills offer a way of addressing this mismatch in ways that can offer nuanced insights into the context, as well as the responses that are needed, and in ways that can avoid the problems of top-down skills planning.

In sum, this study emphasises that historical circumstances, especially colonial legacies in South Africa and Uganda, have cast a lasting impact, fostering an occupational structure that often hinders the adaptability of institutions and skills ecosystems in the face of evolving climate change challenges faced by farmers and extension officers. It is hoped that this study can offer at least some ways of addressing these historical legacies in ways that can benefit farmers who are grappling with the challenges of climate change in Africa.

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APPENDICES

Appendix 1: Climate Resilience Assessment Tool

General Participant Information

Name and Surname:	
E-Mail:	
Mob/Tel. Number	
College/University Faculty	
Position at College/ Faculty	
Programme/course	
Area of specialisation	

Consent for participating in the study and use of data for research purpose

Thank you for accepting to participate in this study. This document serves to obtain your written consent for being involved in this study.

Participant;

- I have received enough information about this study.
- I understand the purpose of the research and my involvement in it.
- I understand that I may withdraw from the research project at any stage.
- I understand that I am participating in this study voluntarily.

Name: _____

Signed: _____

Date: _____

This tool for assessing agricultural VET curriculum responsiveness to Climate resilience focuses on four aspects of the programme curriculum into which it is divided; content(topics), teaching, research and innovation and community engagement.

Section 1 covers the general topics relating to climate resilience (mitigation and adaptation) and assesses the programme's integration of these topics in the curriculum. The topics include Greenhouse Gas Emissions, Water management, Renewable energy, Agroecology, Dryland agriculture/climate-smart agriculture and Climate-resilient infrastructure (for drainage, and waste management). It also assesses the programme's relevancy to the agricultural extension officers, smallholder farmers and food security.

Section 2 of the tool focuses on the programme's teaching approach and assesses its theoretical and practical ability to develop students' competencies to mitigate or adapt to challenges and risks caused by climate change.

Some of the competencies include problem-solving, systems thinking, and integrated problem solving, and the interdisciplinarity of the programme to develop these competencies.

Section 3 is on research and innovation. In this section, the tool focuses on the programme's accommodation of research and innovation for climate resilience. The aspects such as programme's structure, engagement of staff and students in research and innovation, collaborations with other stakeholders like departments and organisations on research and innovation, and financial support for students and staff to engage in research and innovation.

Section 4 of the tool assesses the programme's link to the local community and how students and staff engage in climate resilience community projects. It also focuses on the programme's collaborations with local partners to improve farmers' resilience to climate change for food security and how the selection and implementation of projects in the community are biased towards climate resilience.

Rating	Assessment criteria
0	None. There is a total lack of evidence on the indicator
1	Unsatisfactory The indicator does not meet the requirements.
2	Needs Development Indicates performance, but improvement is required.
3	Adequately evidence show adequate Climate-resilience responsiveness
4	Meets requirements Evidence indicates that the Climate-resilience responsive standard has been met
5	Exceed requirements Evidence indicate that expectations have been exceeded and Climate-resilience responsiveness has been successfully attained

Code	Indicator	Level (score)					
		None (0)	Unsatisfactory (1)	Needs Development (2)	Adequate (3)	Meets requirements (4)	Exceeds requirements (5)
C1	Curriculum (content and topics): integration of Climate resilience topics in the curriculum <i>How would you rate the level of integration of the following general topics on climate resilience in the programme?</i>						
A1	Greenhouse Gas Emissions						
A2	Water management (Ground and rainwater)						
A3	Renewable energy	0	1	2	3	4	5
A4	Agroecology						
A5	Dryland agriculture/climate smart agriculture						
A6	Climate-resilient infrastructure (for drainage, and waste management)						

Total C1							
C2	Section 2: (C2) Programme teaching approach: developing student competencies <i>Rate the level at which the teaching approach develops the following competencies on climate among students</i>	Level					
		0	1	2	3	4	5
B1	The level to which the teaching approach creates awareness of values and ethics such as conservation and respect for the planet, respecting other people’s opinions, innovating for climate and concern towards all life forms.						
B2	The degree to which the teaching approach combines practical and theoretical teaching methods to explain Climate resilience concepts of mitigation and adaptation.						
B3	The extent to which the teaching approach combines formal and indigenous local knowledge to student learning experience on climate change mitigation and adaptation						
B4	The level to which teaching approach creates a sense of responsibility towards the community, ecological system and the environment, while understanding the role one must play as part of these systems.						
B5	The level to which teaching approach assists students to be able to engage in adaptive management and to participate in social innovations that generate new practices.						
B6	The extent to which the teaching approach builds students’ systems thinking skills to understand complex social-ecological systems and their relationship with the climate.						
B7	The extent to which the teaching approach develops students’ Integrated problem-solving skills to assist them develop integrative approaches to mitigate and adapt to climate change.						
B8	The extent to which the interdisciplinary education forms a component of the curriculum e.g., linking extension education, food security and climate change.						
Total C2							

C3	Section 3: (C3) Research and innovation for Climate Resilience <i>Rank the degree you to which you feel the programme integrates the research and innovation on climate resilience</i>	Level					
		0	1	2	3	4	5
D1	The degree to which the programme engages in adaptive management and students participate in social innovations that generate new practices and innovations for climate resilience.						
D2	The extent to which the programme's structure provides flexibility for students to develop research and innovation knowledge on climate resilience.						
D3	The extent to which the programme staff and students are involved in research and innovations for climate mitigation and adaptation.						
D4	The extent to which the department under which the study programme is collaborates with other departments and research organisations to research and innovate solutions for climate mitigation and adaptation.						
D5	The extent to which climate mitigation and adaptation are emphasized research topics in the programme.						
D6	The level of availability of programme bursaries and other grants students and staff to conduct research and develop local farming innovations addressing climate change.						
C4	Section 4: (C4) Community Engagement	Level					
		0	1	2	3	4	5

E1	The extent to which the department (staff and students) are engaged in community programmes/projects addressing aspects of climate change mitigation and adaptation.						
E2	The level of commitment of the department's resources to climate change mitigation and adaptation agricultural projects in the community						
E3	The degree to which local agriculture issues and challenges stemming from climate change form part of the department's community engagement.						
E4	The extent to which the department collaborates with other stakeholders in improving smallholder farmers' climate resilience for improved farm productivity and food security.						
E5	The extent to which aspects of climate resilience (adaptation and mitigation) are used in the selection/execution of community engagement agricultural projects						
	Total C4						

Appendix B 1

Fort Cox Agriculture and Forestry Training Institute

Agribusiness specialisation climate responsiveness computation

Code	Indicator	None (0)	Unsatisfactorily (1)	Needs Development (2)	Adequate (3)	Meets requirements	Exceeds requirements (5)	Sum	Average	percentage
C1	Curriculum (content and topics): integration of Climate resilience topics in the curriculum <i>How would you rate the level of integration of the following general topics on climate resilience in the programme?</i>	Level								
		0	1	2	3	4	5			
A1	Greenhouse Gas Emissions	0		4	3			7	1.4	28%
A2	Water management (Ground and rainwater)		1			12	5	18	3.6	72%
A3	Renewable energy	0	1		3			4	0.8	16%
A4	Agroecology		1	4	6			11	2.2	44%
A5	Dryland agriculture/climate-smart agriculture		1		3	12		16	3.2	64%
A6	Climate-resilient infrastructure (for drainage and waste management)			2		16		18	3.6	72%
A7	The degree to which topics relating to smallholder farm productivity and food security form part of the teaching programme.				3	8	10			
A8	The extent to which the program focuses on knowledge development on climate resilience for farmers, extension officers and other value chain actors.	0				16				
A9	To what extent is the national adaptation plan (NAP) or aspects thereof integrated in the programme curriculum	0	1		9					296%
	Total C1									33%
C2	Programme teaching approach: The level to which teaching approach develops students' competence in climate resilience.	Level								
		0	1	2	3	4	5			

	<i>Rate the level at which the teaching approach develops the following competencies on climate among students</i>										
B1	The level to which the teaching approach creates awareness of values and ethics such as conservation and respect for the planet, respecting other people's opinions, innovating for climate and concern towards all life forms.	0			3	8	5	16	3.2	64%	
B2	The degree to which the teaching approach combines practical and theoretical teaching methods to explain Climate resilience concepts of mitigation and adaptation.							13	2.6	52%	
B3	The extent to which the teaching approach combines formal and indigenous local knowledge to student learning experience on climate change mitigation and adaptation	0			6	8		14	2.8	56%	
B4	The level to which teaching approach creates a sense of responsibility towards the community, ecological system and the environment, while understanding the role one must play as part of these systems.		1	3		8	5	17	3.4	68%	
B5	The level to which teaching approach assists students to be able to engage in adaptive management and to participate in social innovations that generate new practices	0	1			8	5	14	2.8	56%	
B6	The extent to which the teaching approach builds students' systems thinking skills to understand complex social-ecological systems and their relationship with the climate	0	1	2		4	5	12	2.4	48%	
B7	The extent to which the teaching approach develops students' Integrated problem-solving skills to assist them develop integrative approaches to mitigate and adapt to climate change	0	2	2		4		8	1.6	32%	
B8	The extent to which the interdisciplinary education forms a component of the curriculum e.g. linking extension education, food security and climate change.		3	2	3			8	1.6	32%	
	Total C2									408%	
										51%	
C3	Research and innovation	Level									
	<i>Rank the degree you to which you feel the programme integrates the research and innovation on climate resilience</i>	0	1	2	3	4	5				
D1	The degree to which the programme engages in adaptive management and students participate in social innovations that generate new practices and innovations for climate resilience.	0	1	4	3			8	1.6	32%	
D2	The extent to which the programme's structure provides flexibility for students to develop research and innovation knowledge on climate resilience	0	1	2	6			9	1.8	36%	
D3	The extent to which the department under which the study programme is collaborates with other departments and research organisations to research and innovate solutions for climate mitigation and adaptation	0	2	4				6	1.2	24%	
D4	The extent to which climate mitigation and adaptation are emphasized research topics in the programme	0	1	2	3			6	1.2	24%	

D5	The level of availability of programme bursaries and other grants students and staff to conduct research and develop local farming innovations addressing climate change	0		2				2	0.4	8%
	Total C3									124%
										25%
C4	Community Engagement <i>Rate the level at which students and teachers engage with the community for climate resilience</i>	Level								
		0	1	2	3	4	5			
E1	The extent to which the department (staff and students) are engaged in community programmes/projects addressing aspects of climate change mitigation and adaptation	0	4					4	0.8	16%
E2	The level of commitment of the department's resources to climate change mitigation and adaptation agricultural projects in the community	0	3	2				5	1	20%
E3	The degree to which local agriculture issues and challenges stemming from climate change form part of the department's community engagement	0	3	2				5	1	20%
E4	The extent to which the department collaborates with other stakeholders in improving smallholder farmers' climate resilience for improved farm productivity and food security	0	1	2	3			6	1.2	24%
E5	The extent to which aspects of climate resilience (adaptation and mitigation) are used in the selection/execution of community engagement agricultural projects	0	2	4				6	1.2	24%
	Total C4									104%
										21%

Appendix B2

Crop production specialisation climate responsiveness computation

Code	Indicator	None (0)	Unsatisfactory (1)	Needs Development (2)	Adequate (3)	Meets requirement (4)	Exceeds requirement (5)	Sum	Average	Percentage %
C1	Curriculum (content and topics): integration of Climate resilience topics in the curriculum <i>How would you rate the level of integration of the following general topics on climate resilience in the programme?</i>	Level								
		0	1	2	3	4	5			
A1	Greenhouse Gas Emissions	0	0	2	6	4	5	17	3.4	68%

A2	Water management (Ground and rainwater)				3	12	5	20	4	80%	
A3	Renewable energy		1	2	6	4		13	2.6	52%	
A4	Agroecology			4	6	4		14	2.8	56%	
A5	Dryland agriculture/climate smart agriculture			2	3	12		17	3.4	68%	
A6	Climate-resilient infrastructure (for drainage, and waste management)			2	6	4	5	17	3.4	68%	
A7	The degree to which topics relating to smallholder farm productivity and food security form part of the teaching programme.		1			16		17	3.4	68%	
A8	The extent to which the program focuses on knowledge development on climate resilience for farmers, extension officers and other value chain actors.				6	12		18	3.6	72%	
A9	To what extent is the national adaptation plan (NAP) or aspects thereof integrated in the programme curriculum		2		6	4		12	2.4	48%	
	Total C1										580%
									Average		64%
C2	Programme teaching approach: The level to which teaching approach develops students' competence in climate resilience	Level									
	<i>Rate the level at which the teaching approach develops the following competencies on climate among students</i>	0	1	2	3	4	5				
B1	The level to which the teaching approach creates awareness of values and ethics such as conservation and respect for the planet, respecting other people's opinions, innovating for climate and concern towards all life forms.			2	6	4	5	17	3.4	68%	
B2	The degree to which the teaching approach combines practical and theoretical teaching methods to explain Climate resilience concepts of mitigation and adaptation.			2	3	12		17	3.4	68%	
B3	The extent to which the teaching approach combines formal and indigenous local knowledge to student learning experience on climate change mitigation and adaptation			2	6	8		16	3.2	64%	
B4	The level to which teaching approach creates a sense of responsibility towards the community, ecological system and the environment, while understanding the role one must play as part of these systems.		1	2	3	8	5	19	3.8	76%	
B5	The level to which teaching approach assists students to be able to engage in adaptive management and to participate in social innovations that generate new practices			4		4	10	18	3.6	72%	

B6	The extent to which the teaching approach builds students' systems thinking skills to understand complex social-ecological systems and their relationship with the climate		0	2	6	4	5	17	3.4	68%
B7	The extent to which the teaching approach develops students' Integrated problem-solving skills to assist them develop integrative approaches to mitigate and adapt to climate change			2	6	8		16	3.2	64%
B8	The extent to which the interdisciplinary education forms a component of the curriculum e.g. linking extension education, food security and climate change.		0	2	3	12	0	17	3.4	68%
	Total C2									548%
								Average		69%
C3	Research and innovation	Level								
	<i>Rank the degree you to which you feel the programme integrates the research and innovation on climate resilience</i>	0	1	2	3	4	5			
D1	The degree to which the programme engages in adaptive management and students participate in social innovations that generate new practices and innovations for climate resilience.	0	1	2	6	0	5	14	2.8	56%
D2	The extent to which the programme's structure provides flexibility for students to develop research and innovation knowledge on climate resilience	0	0	2	3	12	0	17	3.4	68%
D3	The extent to which the programme staff and students are involved in research and innovations for climate mitigation and adaptation	0	0	0	9	8	0	17	3.4	68%
D4	The extent to which the department under which the study programme is collaborates with other departments and research organisations to research and innovate solutions for climate mitigation and adaptation	0	0	0	6	12	0	18	3.6	72%
D5	The extent to which climate mitigation and adaptation are emphasized research topics in the programme	0	0	2	3	12	0	17	3.4	68%
D6	The level of availability of programme bursaries and other grants students and staff to conduct research and develop local farming innovations addressing climate change	0	1	4	6	0	0	11	2.2	44%
	Total C3									376%
								Average		63%
C4	Community Engagement	Level								
	<i>Rate the level at which students and teachers engage with the community for climate resilience</i>	0	1	2	3	4	5			
E1	The extent to which the department (staff and students) are engaged in community programmes/projects addressing aspects of climate change mitigation and adaptation	0	2	2	6	0	0	10	2	40%

E2	The level of commitment of the department's resources to climate change mitigation and adaptation agricultural projects in the community	0	0	4	6	0	0	10	2	40%	
E3	The degree to which local agriculture issues and challenges stemming from climate change form part of the department's community engagement	0	1	2	6	4	0	13	2.6	52%	
E4	The extent to which the department collaborates with other stakeholders in improving smallholder farmers' climate resilience for improved farm productivity and food security	0	0	2	9	4	0	15	3	60%	
E5	The extent to which aspects of climate resilience (adaptation and mitigation) are used in the selection/execution of community engagement agricultural projects	0	0	2	3	12	0	17	3.4	68%	
Total C4											260%
									Average		52%

Appendix B3

Animal Production specialisation climate responsiveness computation

Code	Indicator	None (0)	Unsatisfactory (1)	Needs Development (2)	Adequate (3)	Meets requirements (4)	Exceeds requirements (5)	sum	Average	Percentage
C1	Curriculum (content and topics): integration of Climate resilience topics in the curriculum <i>How would you rate the level of integration of the following general topics on climate resilience in the programme?</i>	Level								
		0	1	2	3	4	5			
A1	Greenhouse Gas Emissions	0						0	0	0%
A2	Water management (Ground and rainwater)	0						0	0	0%
A3	Renewable energy	0						0	0	0%
A4	Agroecology	0						0	0	0%
A5	Dryland agriculture/climate smart agriculture	0						0	0	0%
A6	Climate-resilient infrastructure (for drainage, and waste management)	0						0	0	0%

	Total C1								0%	
C2	Programme teaching approach: The level to which teaching approach develops students' competence in climate resilience <i>Rate the level at which the teaching approach develops the following competencies on climate among students</i>	Level								
		0	1	2	3	4	5			
B1	The level to which the teaching approach creates awareness of values and ethics such as conservation and respect for the planet, respecting other people's opinions, innovating for climate and concern towards all life forms.	0		2				2	0.4	7%
B2	The degree to which the teaching approach combines practical and theoretical teaching methods to explain Climate resilience concepts of mitigation and adaptation.	0	1					1	0.2	3%
B3	The extent to which the teaching approach combines formal and indigenous local knowledge to student learning experience on climate change mitigation and adaptation	0	1					1	0.2	3%
B3	The level to which teaching approach creates a sense of responsibility towards the community, ecological system and the environment, while understanding the role one must play as part of these systems.	0				4		4	0.8	13%
B4	The level to which teaching approach assists students to be able to engage in adaptive management and to participate in social innovations that generate new practices	0					5	5	1	17%
B5	The extent to which the teaching approach builds students' systems thinking skills to understand complex social-ecological systems and their relationship with the climate	0		2				2	0.4	7%
B6	The extent to which the teaching approach develops students' Integrated problem-solving skills to assist them develop integrative approaches to mitigate and adapt to climate change	0			3			3	0.6	10%
B7	The extent to which the interdisciplinary education forms a component of the curriculum e.g. linking extension education, food security and climate change.	0			3			3	0.6	10%
	Total C2								70%	
								Average	10%	
C3	Research and innovation <i>Rank the degree you to which you feel the programme integrates the research and innovation on climate resilience</i>	Level								
		0	1	2	3	4	5			
D1	The degree to which the programme engages in adaptive management and students participate in social innovations that generate new practices and innovations for climate resilience.	0	1					1	0.2	3%

D2	The extent to which the programme's structure provides flexibility for students to develop research and innovation knowledge on climate resilience	0						0	0	0%
D3	The extent to which the programme staff and students are involved in research and innovations for climate mitigation and adaptation	0						0		0%
D4	The extent to which the department under which the study programme is collaborates with other departments and research organisations to research and innovate solutions for climate mitigation and adaptation	0						0	0	0%
D5	The extent to which climate mitigation and adaptation are emphasized research topics in the programme	0	1					1		0%
D6	The level of availability of programme bursaries and other grants students and staff to conduct research and develop local farming innovations addressing climate change	0						0	0	0%
Total C3										1%
Community Engagement		Level								
<i>Rate the level at which students and teachers engage with the community for climate resilience</i>		0	1	2	3	4	5			
E1	The extent to which the department (staff and students) are engaged in community programmes/projects addressing aspects of climate change mitigation and adaptation	0	1					1	0.2	3%
E2	The level of commitment of the department's resources to climate change mitigation and adaptation agricultural projects in the community	0		2				2	0.4	7%
E3	The degree to which local agriculture issues and challenges stemming from climate change form part of the department's community engagement	0	1					1	0.2	3%
E4	The extent to which the department collaborates with other stakeholders in improving smallholder farmers' climate resilience for improved farm productivity and food security	0	1					1	0.2	3%
E5	The extent to which aspects of climate resilience (adaptation and mitigation) are used in the selection/execution of community engagement agricultural projects	0	1					1	0.2	3%
Total C4										20%
										3%

Appendix C

Gulu University

Bachelor of Science in Agriculture climate responsiveness computation

Code	Indicator	None (0)	Unsatisfactorily (1)	Needs Development	Adequate (3)	Meets requirements (4)	Exceeds requirements (5)	Sum	Average		
C1	Curriculum (content and topics): integration of Climate resilience topics in the curriculum <i>How would you rate the level of integration of the following general topics on climate resilience in the programme?</i>	Level									
		0	1	2	3	4	5				
A1	Greenhouse Gas Emissions				9	24		33	3.3	66%	
A2	Water management (Ground and rainwater)			6	3	20	5	34	3.4	68%	
A3	Renewable energy			4	6	20	5	35	3.5	70%	
A4	Agroecology			6	6	16	5	33	3.3	66%	
A5	Dryland agriculture/climate smart agriculture			8	6	12	5	31	3.1	62%	
A6	Climate-resilient infrastructure (for drainage, and waste management)			8	9	12		29	2.9	58%	
	Total C1									390%	
								Average		65%	
C2	Programme teaching approach: The level to which teaching approach develops students' competence in climate resilience <i>Rate the level at which the teaching approach develops the following competencies on climate among students</i>	Level									
		0	1	2	3	4	5				
B1	The level to which the teaching approach creates awareness of values and ethics such as conservation and respect for the planet, respecting other people's opinions, innovating for climate and concern towards all life forms.			2	12	20		34	3.4	68%	
	The degree to which the teaching approach combines practical and theoretical teaching methods to explain Climate resilience concepts of mitigation and adaptation.			2	24	4		30	3	60%	

B3	The extent to which the teaching approach combines formal and indigenous local knowledge to student learning experience on climate change mitigation and adaptation			8	3	20		31	3.1	62%
B4	The level to which teaching approach creates a sense of responsibility towards the community, ecological system and the environment, while understanding the role one must play as part of these systems.			8	12	4	5	29	2.9	58%
B5	The level to which teaching approach assists students to be able to engage in adaptive management and to participate in social innovations that generate new practices			2	15	12	5	34	3.4	68%
B6	The extent to which the teaching approach builds students' systems thinking skills to understand complex social-ecological systems and their relationship with the climate			8	9	8	5	30	3	60%
B7	The extent to which the teaching approach develops students' Integrated problem-solving skills to assist them develop integrative approaches to mitigate and adapt to climate change			6	12	12		30	3	60%
B8	The extent to which the interdisciplinary education forms a component of the curriculum e.g. linking extension education, food security and climate change.			6	12	8	5	31	3.1	62%
	Total C2									498%
								Average		62%
C3	Research and innovation	Level								
	<i>Rank the degree you to which you feel the programme integrates the research and innovation on climate resilience</i>	0	1	2	3	4	5			
D1	The degree to which the programme engages in adaptive management and students participate in social innovations that generate new practices and innovations for climate resilience.			8	6	16		30	3	60%
D2	The extent to which the programme's structure provides flexibility for students to develop research and innovation knowledge on climate resilience		1	6	6	8	10	30	3	60%
D3	The extent to which the programme staff and students are involved in research and innovations for climate mitigation and adaptation			6	3	16	10	35	3.5	70%
D4	The extent to which the department under which the study programme is collaborates with other departments and research organisations to research and innovate solutions for climate mitigation and adaptation		2	8	9	4		21	2.1	42%
D5	The extent to which climate mitigation and adaptation are emphasized research topics in the programme	0	2	8	3			11	1.1	22%

D6	The level of availability of programme bursaries and other grants students and staff to conduct research and develop local farming innovations addressing climate change	0	2	4				4	0.4	8%
	Total C3									262%
								Average		44%
C4	Community Engagement <i>Rate the level at which students and teachers engage with the community for climate resilience</i>	Level								
		0	1	2	3	4	5			
E1	The extent to which the department (staff and students) are engaged in community programmes/projects addressing aspects of climate change mitigation and adaptation			4	12	16		32	3.2	64%
E2	The level of commitment of the department's resources to climate change mitigation and adaptation agricultural projects in the community			6	9	16	5	36	3.6	72%
E3	The degree to which local agriculture issues and challenges stemming from climate change form part of the department's community engagement		2	8	6	4		18	1.8	36%
E4	The extent to which the department collaborates with other stakeholders in improving smallholder farmers' climate resilience for improved farm productivity and food security			6	9	8	10	33	3.3	66%
E5	The extent to which aspects of climate resilience (adaptation and mitigation) are used in the selection/execution of community engagement agricultural projects			6	15		10	31	3.1	62%
	Total C4									300%
								Average		60%

Appendix 2: Interview schedule

PART 1: LEARNING AND VET (*AEO background and training/orientation*)

- 1. Can you tell us a little about how you came to be an AEO?**
 - *Do you have a background in farming?*
 - *Where did you first develop an interest in farming and AEO work? (e.g. college, family farm, community)?*

- 2. What was your main source of training?**
 - *Who were the providers?*
 - *Did the training result in certification?*
 - *If yes, what type of certificates?*
 -

- 3. Have you attended any short-course training related to agricultural extension?**

- 4. Did the curriculum for the above short-course training or institutional qualifications you received include climate change or environmental sustainability issues? Explain.**

- 5. In the last 5 years have you received any further AE training and support after your initial qualification?**

IF NO:

 - *Why do you think this is?*

IF YES:

 - *What type of support and training?*
 - *From whom?*
 - *Did the training result in certification?*
 - *If yes, what type of certificates?*
 - ***Was this training / support useful for making practical decisions in your role as an AEO?***
 - *Can you give an example?*

- 6. In addition to any formal training, where else do you currently get information from to help you deal with the challenges your farmers may face?**
 - *Sources of information – individuals and organisations, other sources? (e.g. radio, mobile phone – being careful not to lead the participant).*
 - *Does this include interactions between policymakers, academics, or farmers?*
 - *In what ways do they support you in your AEO work?*
 - *Are some sources more useful than others, e.g. radio, farmers over policy advice?*
 - *Do you/your organisation support other actors (including AEOs) that are involved in AE work?*

- 7. Is there any additional training and support you feel would be helpful for your day-to-day work as an AEO?**
 - *What form of training or support?*
 - *How would this help you in our role as AEO?*

- 8. Has your understanding of the AEO role evolved in the last 5 – 10 years? (Or since you first graduated from college/your initial AEO training if sooner)?**

- *How?*
- *What prompted this change?*

9. Are there examples where farmers have taught you based on their own experiences and insights?

- *i.e. using knowledge acquired elsewhere or indigenous knowledge?*

PART 2: WORK AND LIVING (practical links with farmers, and experiences of AEO engagement and knowledge sharing)

10. In your opinion, what is the role of an “Agricultural Extension Officer”?

- *What do they do?*

11. What type of farmers do you support?

12. How does a meeting get arranged?

- *Do they contact you or do you contact them, or both?*
- *How often do you meet with farmers?*
- *Are there any conditions (e.g. payment)?*

13. What do you generally do to assist farmers in your role?

- *What are your responsibilities to the farmers you support?*
- *How do you teach e.g. Do you give farmers things to read, provide demonstrations, field days, discussion groups?*

14. What sort of issues do farmers typically need help with?

- *Are climate-related farming techniques required by farmers?*
- *Do you emphasise renewable energy and energy-saving techniques in your work?*

15. Do you think AEOs face any challenges in trying to do their job?

- *Please explain?*

16. In your experience what sort of challenges are you able to help farmers to solve?

17. Are there examples where farming practice has changed because of your work as an AEO?

18. Are there any important issues that farmers face which AEOs don’t generally help with? If yes, explain them

- *Why do you think this is the case?*

Have you experienced any challenges that you could not help with in your capacity as an AEO?

- *What did you do on this occasion?*
- *Probe – did they try and learn and adapt, e.g. go and find out how you could help the farmer?*

20. Are there examples where farmers decided not to follow the advice or information you gave?

- *Why do you think they did not follow your advice?*

21. Finally, would you have any recommendations on how the AEO role could be improved to respond to challenges AEOs and farmers may face in the future?

Appendix 3: Faculty of Education ethical clearance

3 February

2023 Mr Sidney Muhangi



Rhodes University, Education Faculty
Research Ethics Committee
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Dear Mr Sidney Muhangi and Dr Presha Ramsarup, Distinguished Professor Heila Lotz-Sisitka

Re: A Social Skills Ecosystem Approach to Agricultural Advisory and Extension Services workstreams mapping for VET: A comparative case study of Alice, South Africa, and Gulu, Uganda

APPLICATION NUMBER: 2023-2659-7411

This letter confirms that your research ethics renewal application has been reviewed and **APPROVED** by the Education Faculty Research Ethics Committee (EF-REC).

Approval is granted for 1 year. An annual progress report is required in order to renew approval for an additional period. You will receive an email notifying you when the progress report is due.

Should any substantive change(s) be made during the research process, that may have ethical implications, you should notify the Education Faculty REC Chair via email. This includes changes in investigators. The REC Chair will advise as to whether a new application is necessary.

Do keep this clearance letter secure and accessible throughout your study and after its completion. It will be needed when a thesis is examined and when publications are submitted to journals.

Please also submit a brief report to the REC Chair on the completion of the research. This can be done via email. The purpose of this report is to indicate whether the research was conducted successfully and whether any ethics-related matters arose that the committee should be aware of, in order to guide future studies.

Sincerely,

Prof Eureka Rosenberg

Chair: Education Faculty Research Ethics Committee