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Investigating the Influence of Agricultural Extension Service Providers (AESPS) on Building Inclusive Food Systems Through Underutilised Indigenous Foods Education: A Case Study

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ABSTRACT

South Africa, a rich tapestry of diverse communities, is home to at least nine major ethnic groups (Zulu, Xhosa, Bapedi [North Sotho], Batswana, South Ndebele, Basotho [South Sotho], Venda, Tsonga, and Swati). Each group, deeply rooted in their culture and traditions, consumes a unique array of foods. Often considered indigenous, these foods are sourced from the wild and grown using traditional production techniques. The literature indicates indigenous foods have been a staple in many parts of the country for centuries. Although this study's findings are based on three districts in northern KwaZulu-Natal, similarities have been noted in previous studies conducted within and across regions, particularly in the Southern African Development Community (SADC). The research methodology involved using the Chi-square test method, a correlation analysis, and the computer-assisted qualitative data analysis software package Atlas. Ti. These methods were used to determine the existing relationship between extension services and the production of underutilised indigenous food crops (UIFCs). Theoretical findings then corroborated the statistical data. This research's findings imply that while several agricultural extension service providers (AESPs) advise on the production and utilisation of UIFCs, the inverse was true of others. Participants indicated that much of the knowledge passed to them mainly involved exotic vegetables such as Spinacia oleracea and Brassica oleracea and excluded local foods such as Bidens pilosa and Momordica foetida. One of the emerging themes was AESPs' invisibility in communities, which was found to be a

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contributing factor to non-inclusive food systems. Thus, the study contributes to the knowledge domain by outlining a need for AESPs' visibility in communities and accentuates opportunities that AESPs miss in not participating in building inclusive food systems. The paper concludes by recommending the inclusion of UIFCs in the continued professional development (CPD) of AESPs, wherein the significance of UIFCs would be enshrined.

Keywords: Agricultural Extension Services, Food Security, Inclusive Food Systems, Indigenous Foods, Underutilised Crops.

1. INTRODUCTION AND LITERATURE REVIEW

1.1. Contextualising Indigenous Foods: A SADC Perspective

Indigenous foods remain neglected and underappreciated in several parts of Africa, a situation that poses a significant threat to food security. This neglect and underappreciation have been observed by numerous scholars whose findings indicate that Africa, and the Southern African Development Community (SADC) in particular, stigmatise indigenous foods despite the high levels of hunger in the region (Mudau *et al*., 2022; Legwaila *et al*., 2011; Chivenge *et al*., 2015). This stigmatisation threatens food security, which should evoke a sense of urgency and concern, adversely affecting progress toward attaining the first and second global sustainable development goals (SDGs) to alleviate hunger and poverty. A collaborative study conducted by Bioversity International, Center for International Forestry Research, World Agroforestry, and Charles Sturt University explains indigenous foods' significance – or forest foods as referred to in the study – in sustainable diets. Sustainable diets, in the Indigenous foods context, imply that these foods offer advantages in fulfilling nutritional requirements, ensuring food security and accessibility, promoting health and well-being, acknowledging cultural heritage, embracing eco-friendly, locally sourced and seasonal foods, promoting equity and fair trade, maintaining biodiversity, caring for the environment, and building resilience in the face of the climate crisis (Vinceti *et al*., 2013). Recognising the value of these foods to sustainable diets, specifically underutilised indigenous food crops (UIFCs), the researchers attempt to find the link between the influence of agricultural extension service education on UIFCs' production and consumption. In highlighting the importance of an educational approach to sustainable diets and building inclusive food systems, Burlingame and Dernini (2012) stress the need for information and education about appropriate food choices.

1.2. Positioning Underutilised Indigenous Food Crops (UIFCs) in South Africa's Food Systems

While the need to incorporate UIFCs into the South African food policy, as recommended by researchers, has been acknowledged (Akinola *et al*., 2020; Qwabe & Pittaway, 2023; Shackleton *et al*., 2009), and limited efforts have been made to realise UIFCs' potential fully. At the policy level, no focus is on identifying food systems' critical components. Instead, the emphasis is primarily on issues concerning market accessibility and national food sufficiency (DAFF, 2012). Beyond this, however, is a need to recognise UIFCs' importance in indigenous communities' culture and traditions (Fisher & Du Rand, 2022).

Informed by the consensus study on agricultural education and training's revitalisation in South Africa, which emphasises the importance of further training for agricultural professionals (ASSAf, 2017), the researchers believe that AESPs have the potential to play a significant role in ensuring that farmers are well informed about UIFCs' value and significance. Raidimi and Kabiti (2019) assert that an important contribution can be made towards building sustainable and inclusive food systems by disseminating relevant information to farmers for informed decision-making through extension services. Before this, Raidimi and Kabiti (2019) emphasised the Academy of Science of South Africa (ASSAf) consensus findings, which recommend that to enhance extension personnel's capacity for knowledge dissemination and to achieve the goal of sustainable and inclusive food security, "sustained agricultural extension human resource development through investment in education is a prerequisite." There is limited evidence that AESPs consider UIFCs critical components of food systems. Consequently, this research seeks to determine the opportunities AESPs have missed in building inclusive food systems through recognising UIFCs. To address this overarching objective, the following specific objectives are pursued: (a) determine the presence of AESPs in the study area, (b) assess AESPs' influence on increased production and utilisation of UIFCs, and (c) explore technologies' utilisation in local food systems to improve UIFCs' production.

2. RESEARCH DESIGN AND METHODOLOGY

2.1. Profiling the Study Area

Four areas of interest in the northern KwaZulu-Natal region were purposefully selected based on their indigenous food profiles. These areas fall within the Ilembe (IDM), King Cetshwayo (KCD), and Umkhanyakude District Municipalities (UDM). The three districts are presented

in Figure 1, and the local municipalities from which data were collected are presented in Figures 2-4.

FIGURE 1: KwaZulu-Natal Map Showing All Three District Municipalities

Figure 2: IDM

Figure 3: UDM Map

Figure 4: KCD Municipality

The three selected areas are primarily rural and share similar characteristics. These characteristics include a heavy reliance on agriculture to meet their living needs. Agriculture in the selected regions is critical to the residents' livelihoods and socioeconomic status. The three districts all fall within the northern KwaZulu-Natal (NKZN) region and are deeply rooted in their cultural norms and traditions. Most residents are predominantly Zulu-speaking and are governed by tribal authorities, which all fall within the Ingonyama Trust. This corporate entity was established to administer the land traditionally owned by the Zulu people for the Zulu nation's benefit, material welfare, and social well-being. All the farming communities in the three selected regions benefit from the extension services their respective local Department of Agriculture branches deliver. The Department of Agriculture's local representatives advise and educate on agriculture-related matters to build resilient, food-secure communities.

2.2. A QUAL + Quan Mixed Method Paradigm

The case study adopted a mixed methods research paradigm, using a QUAL + quan theoretical notation. QUAL + Quan is one of the mixed methods typologies accepted as a logical method of research that parallels an inductive technique, recognises both quantitative and qualitative

approaches, and allows for their coexistence (Costa & Tumagole, 2020; Creswell & Plano, 2011). The QUAL + quan typology can be presented as depicted in Table 1.

TABLE 1: QUAL + Quan Typology Modelled from Costa and Tumagole (2020)

Theoretical notation	**Logical Approach**	**Design typology**	
		Core	*Supplemental*
QUAL + qual	Inductive Simultaneous	Qualitative	Quantitative

QUAL + quan, as a valid research approach, enabled the integration of theoretical and numerical data obtained from the study participants. The General/Human Research Ethics Committee (GHREC) at the University of the Free State granted ethics approval for this study and issued the clearance number UFS-HSD2020/0080/0604. In-depth interviews and surveys were credible research instruments that yielded sufficient data for this research.

2.3. Data Analysis

Qualitative data were analysed inductively through Atlas. Ti, a computer-assisted data analysis software package that helps organise, analyse, and generate insights from responses to open-ended questions. Qualitative data focused on farmers' perceptions and sought to understand if UIFCs were included in extension personnel's teaching. The analysis included a three-phase approach wherein data were captured in Microsoft Word. It was then imported into Atlas. Ti, wherein codes were generated, and the themes of interest were selected. In making a statement concerning inductive analysis's reliability, German et al. (2018) assert that "it almost invariably involves collecting data, breaking it up […] and then abstracting at a higher level […] this process is at the heart of what most theory-building qualitative researchers are doing." The quantitative data were analysed through a correlation Chi-square test using the following formula:

$$\chi 2 = \frac{\sum(Oi - Ei)^2}{Ei,}$$

Where Oi = observed value (actual value) and Ei = expected value.

The correlational analysis allowed the researchers to determine the existing relationship between agricultural education and the utilisation and production of UIFCs.

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3. RESULTS

The indigenous vegetables presented in Table 2 are some of the most commonly utilised crops in the study area. These crops are critical in the northern KZN region's food systems.

TABLE 2: Example of UIFCs Mainly Utilised in Northern KZN

Scientific name	Common name	Origin	Growth habit
Amaranthus	Pigweed	W	Af
Bidens Pilosa (L.)	Blackjack	W	Af
Colocasia esculenta (L.) Schott	Taro	C	Af
Ipomoea batatas (L.)	Sweet potatoes	C	Cl; He
Ipomea plebeia R.Br.	Imbilikicane (no English name)	W	Cl; He
Manihot esculents Crantz	Cassava	C	Sh; W
Momordica foedita	Wild cucumber	W	Cl; Sw
Solanum retroflexum Dunal	Black nightshade	W	Af
Vigna subterranea (L.) Verdc.	Bambara groundnuts	C	Af
Vigna unguiculata (L.) Walp.	Cowpea	C	Af

Origin: C=cultivated; W=wild. **Growth habit:** Cl=Climber; Af=Annual forb; He=Herbaceous; Sm=Semi-woody; Sh=Shrub; W=Woody.

Three significant themes from the data analysis centred on extension officers' presence in the farming communities emerged. These were extension officers' lack of motivation and knowledge, AESPs' influence over increased production and UIFCs' utilisation, and the integration of technologies into traditional farming techniques to improve IFC production.

3.1. Presence of Agricultural Extension Service Providers (AESPs)

Most farmers indicated concern about the lack of AESPs in rural communities and are still determining the reason for this lack of visibility. However, it is assumed that this is due to a need for more resources to carry out extension service work or limited staff turnover to service

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all the communities in northern KZN. The farmers' assertions include those presented hereunder.

> "Please remind me, where does one find extension officers?" – Female farmer/ IDM/June 2021
>
> "They once visited. They would go to Nsiwa (local school). Sometimes, they would even announce that there would be advisors at the school, and then if you feel like attending, you would. This was the only visit that we had with advisors. After that one, I never heard anything." – Female respondent/KCD/July 2021
>
> "Agricultural advisors could be our sources of information if they could make time, have a conversation with us, and explain how we can access the market. But we do not have such people in this area" – Female farmer/UDM/August 2021

In all the areas under investigation, farmers expressed the disadvantages resulting from the AESPs not being more visible. However, based on the assertions made during the interviews, the farmers maintained a certain degree of confidence in extension agents regardless of their unavailability. An example was the UDM farmer who avowed that if there were extension agents in UDM, farmers would get better advice on accessing markets where they could sell their produce. Mmbengwa *et al.* (2019) and Qwabe *et al.* (2022) assert that through AESPs' active participation in educating farmers about marketing and increasing productivity as critical factors in farming, smallholder farmers could enhance their income levels.

3.2. The Influence of AESPs on Increased Production and Utilisation of Underutilised Indigenous Food Crops (UIFCS)

Most farmers showed concern about professionals in the food systems, particularly AESPs, and their lack of recognition of UIFCs. According to the farmers, UIFCs are essential to their culture and heritage. However, over the years, limited support has been received concerning the production of these crops, even at an advisory level. Farmers claimed that in rare instances when government and non-government officials offer advice and support, they always favour exotic food plants (EFPs) such as *Brassica oleracea* and *Spinacia oleracea*. The unintended effect of this bias is UIFCs' extinction, which threatens biodiversity and culture in Indigenous communities. Farmers made the assertions presented below.

"Education, TVs, and cell phones have destroyed our nation. Nowadays, even professionals have turned their backs on their foods. We send you to school so that you could improve our knowledge and practices, but instead, you do the opposite and promote Western practices." – Male farmer/ IDM/June 2021

"Schools are the main problem; you people teach our children not to appreciate indigenous foods. Have you ever seen amadumbe (Colocasia esculenta (L.) Schott) or izindlubu (Vigna subterranea (L.) Verdc.) planted in any school, clinic or any public area? I blame people like yourself." – Female farmer/KCD/July 2021

"We love all kinds of food, indigenous or not; we appreciate it as long as there is no hunger in the household. However, if we are to be honest, we are the children of the soil, and we have food preferences that are tied to our culture. We need to be supported on such foods, especially since they also have medicinal value. We do not like these Western medications; they are not good for us" – Female farmer/UDM/August 2021.

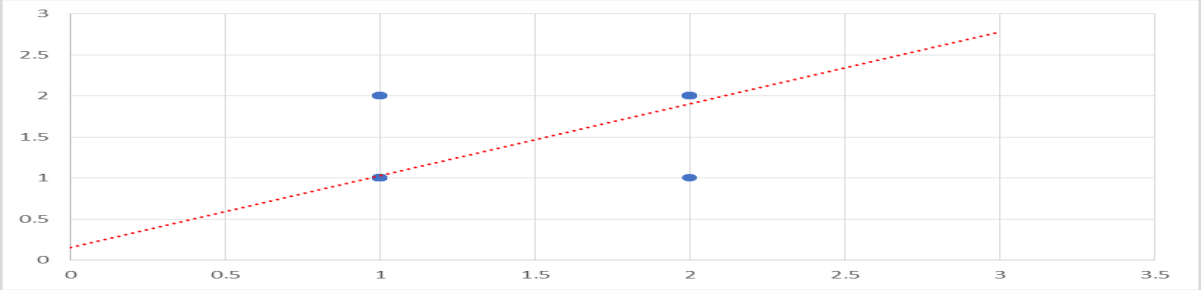

FIGURE 2: Chi-square Statistic on the Relationship Between Agricultural Education and the Utilisation of UIFCs

Although the qualitative findings imply that agricultural education does not increase UIFCs' utilisation, the Chi-square statistic indicated that education and awareness provided by AESPs enhance indigenous vegetables' production and consumption. Thus, the claim that ESPs do not positively contribute to UIFCs' increased production and utilisation was rejected with a P value of 3, 32114E-24. It was interesting to note that the Pearson correlation coefficient of 0.73634 indicates a perfect positive relationship between the time invested by AESPs and the production rate of indigenous foods. Figure 2 indicates a positive linear relationship depicting AESPs' positive work.

3.3. Willingness to Provide Advisory Services

Among the three themes that emerged from this research was AESPs' willingness to serve. Farmers believe that AESPs must provide more advisory services to improve rural farmers' socioeconomic status and livelihoods. This claim was made because AESPs do not like to conduct fieldwork, cannot relate to farmers' context, and thus fail to meet their needs. The following comments from farmers were recorded.

> "You would know that there is an extension officer, but you just never see them" – Female farmer/ IDM/June 2021
>
> "My thinking is that our extension officer grew up in cities and towns where no agricultural activities occur. Then she studied agriculture, yet she knew nothing about farming. Like our extension officer, she is a city girl, and she knows nothing about farming." – Female farmer/ IDM/June 2021
>
> "When you have been well educated and completed your studies at the university, do your work. Do not just sit and get paid for doing nothing. There is no truth in that. As we speak, we produce in abundance, but we do not even have access to the market, yet we have advisors. Kanti, what is their job? There is a lot that we could accomplish if we had dedicated extension advisors." – Female farmer/KCD/July 2021
>
> "It is only you, the younger generation, that will bring the change, but only if you care." – Female farmer/UDM/August 2021

The researcher observed the study participants' body language and verbal expressions during data collection. They were not pleased with the AESPs' poor service delivery.

3.4. Integrating Technology with Indigenous Production Systems to Enhance the Production of UIFCs

This section investigated the possibility of integrating farming technology with traditional systems to enhance IFC production. The supposition that no technologies could be integrated into indigenous production systems was rejected with a P value of 0,016249199. Indigenous communities have found ways of assimilating traditional systems with technology to adapt to changing environmental and climatic conditions (Stöber *et al*., 2017). The devastating effects of climate change have caused three significant challenges, namely (1) high vulnerability to the consequences of climate change, (2) high poverty rates, and (3) high population densities.

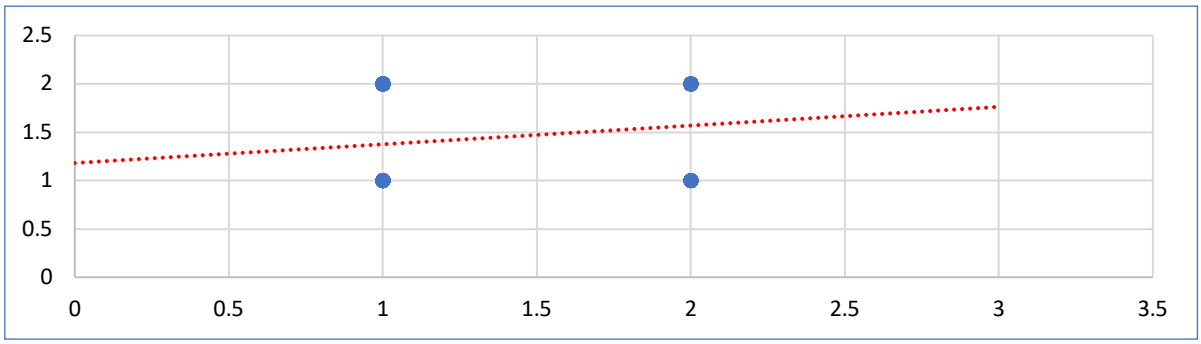

Figure 3: Technology Use in the Production of UIFCs

A Pearson correlation coefficient revealed a score of 0,172102 regarding the nature, strength, and direction of the relationship between traditional methods employed to overcome production threats and technology integration. This statistic means that the relationship between these variables needs to be known. This statistical result could imply that although community members may be aware of the potential to integrate technology with traditional systems to improve IFC production, this integration is rarely implemented.

4. DISCUSSION

In understanding the food system as a combination of elements and activities related to food production and consumption, along with economic, health, and environmental effects, the inclusion of UIFCs in food systems through formal and informal education is paramount in a country such as South Africa where there is a divide between the elite and the poor. This is especially true in the context of farmers from previously disadvantaged communities whose financial streams are limited due to a lack of employment opportunities, education, and gender-specific roles in the job industry. However, this study's findings indicate that only limited information on the promotion, protection, and management of UIFCs, such as those presented in Table 1, is shared with farming communities. Over the years, UIFCs' significance has been emphasised due to their potential to contribute to achieving the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs). These goals prioritise reducing the number of people globally experiencing extreme poverty and hunger.

4.1. Opportunity for Extension to Promoting UIFCs

The primary role of agricultural extension is to provide farmers with accessible information on innovative agricultural practices developed by agricultural research stations. In this

research context, such information includes IFC production, as such crops have been recognised for their high socioeconomic value. This high level of recognition for UIFCs is due to their botanical and health benefits, ease of access, and economic value for farmers.

However, one of the most significant concerns is that extension services pay limited attention to the production and utilisation of these crops. This neglect marginalises indigenous species and threatens food and nutrition security and biodiversity within the food system. Whether UIFCs can help feed the world has been debated, and the Food and Agriculture Organisation (FAO) of the United Nations has made it clear that UIFCs alone cannot solve the broader food system challenges but can be of significant value. This is because they can be cultivated crops or naturally occurring wild plants, exhibit synergies with the natural environment and biodiversity, adapt to local conditions, offer diversification, have a light carbon footprint, generate fewer negative externalities, and require fewer external inputs, especially during the production phase (FAO, 2017).

UIFCs are closely tied to indigenous communities' culture and social and religious activities. For this reason, there is an opportunity for AESPs to upskill themselves in UIFCs and offer the necessary advisory services to farmers to strengthen regional food systems. In knowing more about Indigenous crop varieties, particularly at a local level, agricultural advisors are in a better position to enhance local food systems by:

- Identifying Indigenous crop varieties that have a high potential for commercialisation.
- Determining Indigenous species that are beneficial in mitigating environmental and climate change-related challenges.
- Maintaining agrobiodiversity.
- Focusing on improving yields while employing minimal chemical inputs.

4.2. Resource Efficiency in Building Inclusive Food Systems

The efficient use of resources is one of the critical elements emphasised in agricultural extension. Resource efficiency refers to utilising technology to build inclusive and resilient food systems in IDM, KCD, and UDM. In an era where technology plays a critical role in livelihood development, technology can be utilised to enhance knowledge of building inclusive food systems by integrating UIFCs. An example is utilising digital technology to communicate information related to UIFCs, which Patil (2012) refers to as the production

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function. Such an approach would help inform farmers and extension practitioners and reduce the stigma attached to UIFCs. With the invention of artificial intelligence (AI), the agricultural sector has witnessed improvements in sustainability practices. This includes addressing climate variability and allowing farmers to develop mitigating strategies proactively when necessary. When AESPs and farmers take advantage of AI, especially in promoting UIFCs, it becomes possible to alleviate the burdensome challenges that directly result from climate change. These challenges include high vulnerability to the consequences of climate change and high poverty rates. It is worth noting that in the three regions from which data was sought, AESPs are aware of AI-powered tools that can potentially increase IFC awareness, which could hasten integrating UIFCs into the national food system. However, persisting challenges include (i) the need for knowledge and expertise in utilising AI technology to change practices and behaviour, (ii) the recognition that IFPs are an integral part of the food discourse, and (iii) the inability to realise the convenience of building an inclusive food system through technology.

4.3. AESP Footprint: Availability, Accessibility and Willingness to Drive Change

To take advantage of the opportunities listed above and embrace AI technology to build an inclusive food system, AESPs must improve their skillset and knowledge of the latest advancements in the field and the broader food systems. AESPs must value and promote education to build inclusive food systems. Equally important is AESPs' availability, accessibility, and willingness to drive change. It is difficult to build trust with people with whom you barely interact. To build inclusive food systems, AESPs must be visible among farming communities, which will help build trust and rapport. This means that AESPs in the three district municipalities in this investigation need to be visible and interact with the farmers in groups and one-on-one sessions.

5. CONCLUSION AND RECOMMENDATIONS

The study appreciates the crucial role that AESPs play in communities. However, attention is drawn to agricultural advisors' missed opportunities to strengthen food systems by including IFC education in IDM, KDM, and UDM. Parallel to this is the need for AESPs visibility in the communities they serve to establish a rapport with the farmers and understand the food system(s) in the context of their farming communities. The following list of recommendations were made.

- To build inclusive local food systems, AESPs need to make deliberate efforts to understand the food context in the communities in which they operate. Understanding the food system at the local level will help to identify gaps and missed opportunities that require improvement.
- To better understand the food system(s) in the farming communities' context, it is imperative that AESPs first build a rapport with the local farmers.
- Incorporating UIFCs into AESPs' formal training and continued professional development (CPD) will encourage AESPs to recognise UIFCs' value and why they are a vital part of the food systems.
- Understanding the benefits of technology in crop production, adopting a strategy that integrates technology into local farming systems and IFC production becomes necessary.
- Utilise informal education as an approach to emphasise UIFCs' significance.

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The Challenges of Extension Service Delivery and its Determinants in the Agricultural Extension System: An Insight from a Study in North-Western Ethiopia

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ABSTRACT

The present study examined the significant bottlenecks of extension service and determinants of service delivery in North Western Ethiopia. A total of 120 sample households were randomly selected using a multistage sampling technique to represent the highland, lowland, and midland districts in the former North Gondar zone. Both qualitative and quantitative data were collected. Through descriptive and econometric analysis, the study found that the bottlenecks to the effectiveness of the extension service delivery are highly connected to the poor functioning of farmer training centres, the top-down approach, the limited capacity of development agents, and poor infrastructure. Specifically, the model results for the variables participatory extension approach, integrated extension service, land size, and demonstration showed a positive and statistically significant influence, with coefficient values of 0.734, 0.496, 0.096, and 0.701, respectively. Based on the results, it was concluded that the existing extension service delivery practices were very low due to multiple and interlocking challenges that demand concerted efforts at different levels. Therefore, extension services should be designed based on local problems and challenges, with intimate interaction with farmers and stakeholders and move away from a one-size-fits-all approach.

Keywords: Bottlenecks, One-size-fits-all, Logit Model

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1. INTRODUCTION

Ethiopian agriculture still plays a pivotal role in the overall gross domestic product (GDP), providing most of the population with employment opportunities. Nearly 80% of the country's population lives in rural areas where agriculture is the main livelihood activity, generating income for household consumption to sustain their livelihoods (IFAD, 2023). Moreover, the sector contributes hugely to foreign currency earnings, estimated to be 32.5 percent of countries' GDP through the export of agricultural commodities (CSA, 2015; NBE, 2021). It is believed that a successful extension system can be a vehicle for the diffusion of new knowledge about agricultural practices, improving production and productivity as well as the income of farmers through the dissemination of new agricultural technologies that are deemed helpful for their farming system (Birkhaeuser et al., 1991; Abate, 2008; Leta et al., 2017; Ketemaw et al., 2022).

Agricultural extension is one of the formal systems applied in many developing countries to shape the direction of agricultural development through the transfer of new state of the art to the farmers through appropriate means of dissemination (Khan et al., 2012; Rickards et al., 2018; Yadov et al., 2023). Ethiopia has a long history of implementing an extension system since 1953, following the establishment of the then-imperial Ethiopian College of Agriculture and Mechanical Arts (MoANR, 2017). Since then, considerable changes have been registered from quantitative perspectives. For instance, the rollout of input distributions has shown improvement from 33 to 71%, while the number of beneficiaries of agricultural extension services has tripled from 3.6 to 10.8 million between 2004 and 2010 (Guush et al., 2018).

However, the production and productivity of agriculture in many parts of Ethiopia have not improved despite the efforts exerted in agricultural extension since its inception in 1950 (MoFED, 2009; IFAD, 2023). Even though the agricultural extension system in Ethiopia is decentralised and well-structured, it is still criticised for its low quality of service and poor monitoring and evaluation system (MoANR, 2017). The extension system is expected to play a paramount role in boosting the production and productivity of the agriculture sector. Since the agricultural system was still characterised by a low level of agricultural service delivery

practice, it couldn't move the existing traditional agriculture into a modern one. A top-down approach also characterised the implementation (Leta, 2018).

Studies have shown that rural farmers, particularly those from disadvantaged and impoverished backgrounds, prioritise agricultural extension over all other service requests to improve living standards and agricultural productivity (Kwapong, 2012; Hamasalih & Layeeq, 2023). On top of that, for sector-wide improvement and sustainability extension, service delivery plays a pivotal role in the rural economy (Blackmore et al., 2015**;** Abu et al., 2024). However, according to the OECD (2010), there are significant obstacles to implementing agricultural extension services because of accessibility issues. Moreover, the supply-driven system in Ethiopia was considered one of the bottlenecks for service delivery (Tewodaj et al., 2009; Leta, 2018). Thus, the present study aimed to document and evaluate agricultural extension delivery services in the North Gondar zone of the Federal Democratic Republic of Ethiopia. Notably, the existing agricultural extension services delivery, as well as the determinants and significant agricultural challenges innate in the study area, were examined through the support of first-hand primary data.

2. METHODOLOGY

The study was conducted in the North Gondar zone, which is currently divided into the North Gondar, Central and West Gondar zones in Amhara National Region State. These zonal administrations cover the lowland, highland and midland agroecology. In this study, both quantitative and qualitative approaches were employed. Put differently, the approach employed in this study was a mixed type. The use of multi-method can help triangulate and augment data for better discussion because it provides greater confirmation of data through triangulation and, on the other hand, to elaborate or develop analysis based on rich details (Miles & Hubermann, 1994; Yeasmin & Rahman, 2012; Creswell, 2009; Dawson, 2009; Bans-Akutey & Tiimub, 2021)

2.1. Sampling Procedures and Techniques

A multistage sampling technique was employed for the overall study of this research. Based on the multistage sampling technique, the Amhara Regional State, specifically the North Gondar zone (former name), was selected purposively since it is the largest zone in the region and can create opportunities to represent the region. Secondly, the North Gondar zone stratified

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based on agroecology to form a homogeneous stratum for the selection of woredas. Accordingly, the woredas were grouped into Dega, Woinadega and Kola. Then after, from the dega Wogera woreda, woinadega dembia woreda and the kola/lowland Metema woreda were selected purposively to have representative woredas in North Gondar. As a continuation of the multistage sampling, kebeles were randomly selected from each stratum. The sample size for this study considered the number of variables to be included in the model. As a result of this, 120 sample households have been used that can be sufficient for the logistic regression that considers 10 explanatory variables (Peduzzi et al., 1996; Srimaneekarn *et al*., 2022)

Multiple data collection techniques wereutilised to gather pertinent data for the specified objectives. To that end, a survey design with the support of well-organised and pre-tested interview schedule has been conducted. At the same time, to substantiate the quantitative data, two (02) focus group discussions were conducted, each composed of 8 and 10 discussants for Metema and Dembia districts, respectively. We have also employed 30 development agents from three of the districts. Moreover, key informant interviews (KII) and observations of the reality were conducted as data collection methods.

2.2. Methods of Data Analysis

Both quantitative and qualitative data were used for this study. As a result, both quantitative and qualitative analysis techniques were recruited. Descriptive statistics such as the mean and econometrics models were utilised to analyse the quantitative data. At the same time, organisation, categorisation, and synthesis of the qualitative data were done to substantiate the results of the quantitative analysis.

The econometrics model (notably the binary logit model) has been used to analyse the determinant factors for extension service delivery practice. Service delivery is a broad concept that combines accessibility and utilisation of the service. In this study, as a proxy for service delivery, the utilisation aspect has been denoted by farmers' satisfaction with the given agricultural extension service. Thus, the dependent variable extension service is considered a dummy variable based on farmers' level of satisfaction with a given extension service. Farmers' evaluation of the existing extension service delivery has been categorised as satisfied and non-satisfied farmers. Thus, based on this categorisation, 1 was given to those who were satisfied with extension service delivery and 0 for those who were not satisfied.

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Based on the following empirical works conducted so far such as Assefa and Gezahegn (2010), Asiedu (2013), Elias et al. (2015), Hazem *et al*. (2021) and Hu *et al*. (2022), the variables indicated in Table 1 are hypothesised to influence extension service delivery which according to this study is proxied with the satisfaction of farm householders with the given extension service delivery.

TABLE 1: Variable Definition and Hypothesis

Variables	Measurement	Variable nature	Hypothesis
Extension service approach (APPROACH)	1= Participatory 0 =non-participatory	Dummy	+
Participation in farmers' field day (FIELDDAY)	1= Participated 0= Not participated	Dummy	+
Development agent's follow-up (FOLLOW-UP)	1= There is follow-up 0= No follow-up	Dummy	+
Location of the farm household from the Office of Agricultural Extension/Development agents (HHLOCT)	Distance in minutes	Continuous	+
Access to multiple extension services to the farmer (INTEGRATION)	1= Yes 0= No	Dummy	+
Access to credit (CREDIT)	1=Access 0= No	Dummy	+
Exposure to the demonstration sites (DEMO)	1=Yes 0=No	Dummy	+
EDU	1= Literature 0=Illiterate	Dummy	+
Age of the household head (AGE)	Age of Household head in years	Continuous	-
LANDHOLD	Landholding in hectares	Continuous	+

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3. RESULTS AND DISCUSSIONS

3.1. The Socio-Economic Characteristics of the Respondents

The socio-economic characteristics of the respondents are presented in Table 2. Most respondents were male (77.5%), whereas female-headed households accounted for 22.5%. Similarly, Jemal (2018) underscores the dominance of male-headed households in Ethiopia. Concerning literacy level, 78.3% of the respondents were illiterate, and 21.7% were able to read and write and had formal education. In terms of marital status, the study found that 73.3%, 15%, 7.5%, and 4.2% of the respondents were married, single, divorced, and widowed, respectively.

TABLE 2: Socio-Economic Characteristics of the Respondents (N=120)

Indicators		**Frequency**	**Percent**
Gender:	Male	93	77.5
	Female	27	22.5
Literacy level:	Literate	26	21.7
	Illiterate	94	78.3
Marital status:	Single	18	15
	Married	88	73.3
	Divorced	9	7.5
	Widowed	5	4.2
Wealth status	Rich	7	5.8
	Medium	46	38.4
	Poor	67	55.8
Indicators	**Mean**	**Min**	**Max**
Age	44.5	21	77
TLU	5.22	0.3	18.11

The respondents ranged between 21 and 77 years old, with an average age of 44.5 years. In this study, the tropical livestock unit (TLU, hereafter) used to measure possession of livestock shows that, on average, the respondents possessed 5.22 TLU with a minimum and maximum

of 0.3 and 18.11 TLU, respectively. 55.8% of the respondents were classified as being poor, 38.4% as medium, and 5.8% were found to be in the rich category. This indicates that most of the respondents in the study area were poor (see the wealth ranking in Appendix IC).

3.2. Agricultural Production Challenges

The agricultural production challenges (Figure 1) in the study area were assessed to determine whether agricultural extension services could respond to the existing problems. The cost of inputs (80.8%), shortage of grazing land (75.8%), and shortage of animal forage (74.2%) were the major challenges faced by the farmers.

The price of agricultural inputs has been seen to be very high due to several factors such as insufficient availability, global price surge as much of the inputs are imported, and an accessibility factor due to remoteness (Kibrom *et al*., 2024) For instance according to Getahun and Mahlet (2022), the current price (as of October 2022) increments as compared to last year estimated to be 150% high, which curtails farmers ability to buy fertiliser. The delay in the distribution of agricultural inputs could further exacerbate the problem.

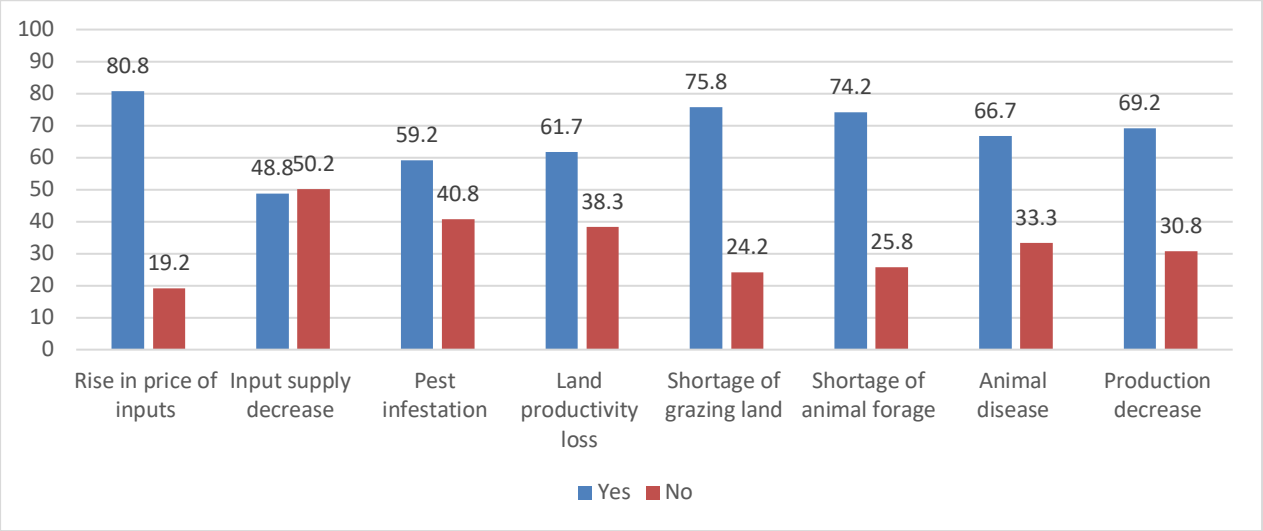

FIGURE 1: Agricultural Production Challenges in the Study Area

The success of agricultural extension delivery depends heavily on farmer training centres, the extension approach, the capacity and satisfaction of development agents, and the existing infrastructure. In contrast to this, the survey results from development agents, as previewed in Figure 2, indicated that non-functional farmer training centres (FTCs hereafter), the top-down

approach, limited capacity of Development Agents (DA), poor infrastructure and the dissatisfaction of development agents had been strongly agreed among development agents with the percentage of 73%, 62%, 51%, 58% and 41%, respectively. According to Ketemaw *et al*. (2022), FTCs are critical for improving crop productivity and farm households' income, but they are poorly functioning in the study area.

The supply-driven or top-down approach is one of the main limitations of extension service delivery in the present study. Such an approach has received strong criticism as it merely focuses on the demand from the government side rather than understanding the context of farmers' needs (Maulu *et al*., 2021). On the other hand, the functionality of farmer training centres in this study is very low, similar to the study conducted in Ethiopia by Suleymen *et al*. (2021). The dysfunction of the extension service delivery can be attributed to poor planning, a lack of capacity, and a limited focus on agricultural marketing (Leta, 2018; Radi et al., 2020; Maulu *et al*., 2021).

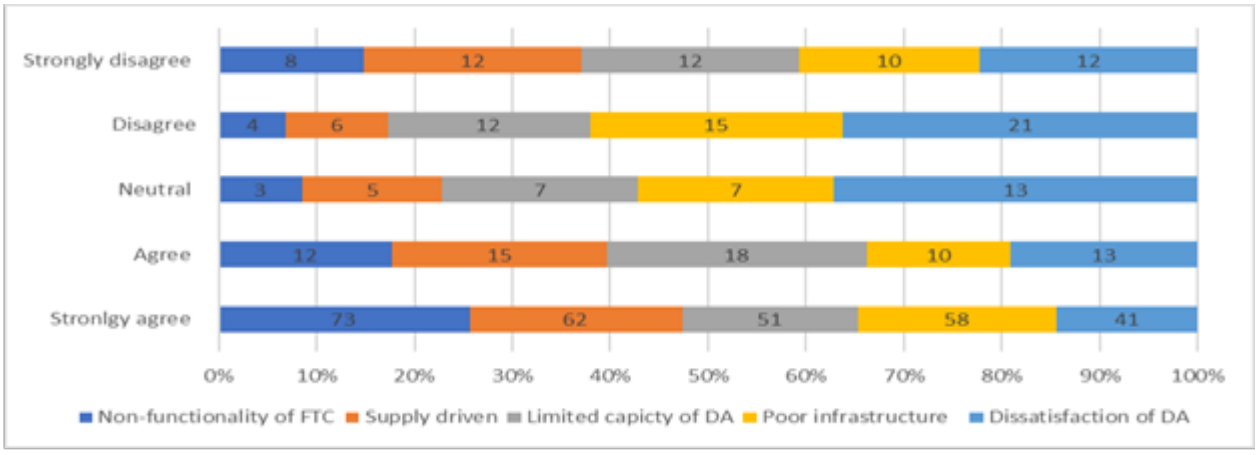

FIGURE 2: Farmer's Attitudes on the Limiting Factors for Extension Service Delivery in the Study Area

In addition to the above descriptive analysis, the challenges in agricultural extension services have been qualitatively assessed through focus group discussions undertaken in Dembia and Metema districts. The results of the discussions help to understand the multidimensional challenges of extension service delivery. The discussions have been synthesised as follows. Firstly, non-functional farming training centres were identified as one of the challenges attributable to poor planning. Secondly, the discussants agreed that there is a limited capacity of development agents and a lack of efforts in capacity development. This is also clearly noted

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from the review results by Leta (2018) and Maulu et al. (2021). The third and most important part of the focus group discussion connected with the limited effort on agricultural marketing extension that inclined to the production aspect. Radi et al.'s study (2020) also confirmed the limited effort given to agricultural marketing extension in Jordan. Moreover, lack of fairness and corruption to some extent, lack of memorandum of understanding for stakeholder integration, lack of commitment among farmers to put training into practice and lack of vehicle facilities for better accessibility of kebeles were also mentioned as additional weakside of the extension system in the discussion. Similarly, studies have shown ineffective extension services in different countries were due to a lack of incentives for extension workers and limited capacity-building efforts (Oluwasusi & Akanni, 2014; Adnan *et al.,* 2023).

In the present study area, one of the key informants in Dembia district meticulously explains that "the extension service they received from the local development agents are not consistent and in synergy with the different agricultural activities instead are driven by top-down campaign based seasonal tasks. Also, bureaucratic multi-tasking was one of the main challenges for public extension service delivery (Blackmore *et al*., 2015), and sometimes political agendas compromise agricultural development. In line with this study, Leta *et al*. (2017) stated that the extension system merely has a brokerage function between the system and the farmer. This signals the need to revisit the extension approach.

3.3. Influencing Factors of Extension Services Delivery in the Study Area

The results of the extension services employed in this study are shown in Table 3. The results revealed that the adoption of extension services observed in the study was very low except for fertiliser use. The role of extension is to provide general service regardless of commodities. However, the extension service is limited to crop production under this study. Livestock extension has been expected to play a pivotal role in improving the income and nutrition of households and, ultimately, rural livelihoods. However, the focus group discussion conducted by Metema and Dembia confirmed that the lack of integration of crop extension with animal extension is the major weakness in agricultural extension service delivery. A similar study in Burkina Faso, Mali, and Benin also revealed a low level of livestock extension service (Pousga et al., 2022).

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Concerning water and soil management, only 58.3% of the respondents were engaged in such training and practices. However, participation in water harvesting practices was very low (29.2%). This indicates that attempts at soil and water management extension activities still require further efforts to improve the prevailing situation. In line with this, the study also recognised a low level of meteorological information dissemination for early warning and preparedness. Nearly 66.7% of the respondents in the study area did not have access to meteorological information.

Relative to other services, the extension service for fertiliser use was higher, accounting for 70.8%. However, the extension role in poultry and dairy cows is very low, at 25% and 28.3%, respectively. The demonstration site's role in the extension service is slightly more than half of the total responses (57.5%). Extension initiatives that provide farmers with appropriate market information can significantly contribute to sustainable agricultural development. However, in the present study, only 38.3% of respondents had access to marketing information. This indicates that, though the production aspect has its problems, it is noted that much emphasis has been given to production while ignoring the marketing extension that helps to connect good producers with market access. As stated above, this study is also similar to the study by Radi et al. (2020). Similarly, the extension service delivery in animal feed, irrigation use, water harvesting and meteorological information access were very low, accounting for 38.3%, 33.3%, 29.2%, and 33.3%, respectively. This implies that much of the extension service is concentrated in distribution, ignoring the other very important services for improving the agricultural sector.

TABLE 3: Extension Service Delivery in the Study Area

Extension services	Response	Frequency	Percent
Fertiliser use	Yes	85	70.8
	No	35	29.2
Improved dairy cow	Yes	34	28.3
	No	86	71.7
Improved poultry	Yes	30	25.0
	No	90	75.0
Demonstration site	Yes	69	57.5

	No	51	42.5
Market access	Yes	46	38.3
	No	74	61.7
Animal feed training	Yes	46	38.3
	No	74	61.7
Soil and water conservation	Yes	70	58.3
	No	50	41.7
Irrigation training and consultation	Yes	40	33.3
	No	80	66.7
Water harvesting	Yes	35	29.2
	No	85	70.8
Meteorological information	Yes	40	33.3
	No	80	66.7

The overall satisfaction of the farmers with the extension delivery services is presented in Figure 3. The results indicate that about 67% of the respondents were dissatisfied with the extension delivery services, while 33% were satisfied. This implies that much still needs to be done to improve the extension service in the study area. The same result has been noticed in East Gojjam, which signals the universality of low levels of extension delivery services in the Amhara region (Elias et al., 2015).

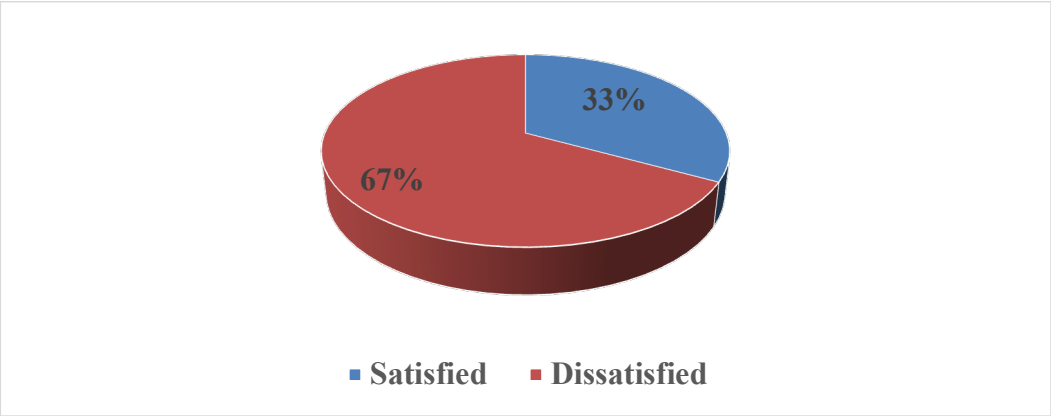

FIGURE 3: Farmer's Satisfaction with Extension Delivery Services

As indicated in the methodology section, the logit model has been used to examine influencing factors in the study area. Before proceeding to the model, the need to test for multicollinearity

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among the various explanatory variables is worth mentioning. Firstly, the discrete variables were tested for correlation, as described in Gujarati (2004) and Shrestha (2020). A multicollinearity test was conducted using the correlation coefficient and variance inflation factor. Accordingly, the correlation should not exceed 0.8 to avoid collinearity problems. Secondly, the variance inflation factor (VIF, hereafter) has been used to test multicollinearity for continuous variables. As shown in Appendix IA and Appendix I B, there is no multicollinearity problem among the discrete variables, which are all less than 0.27.

Similarly, following Gujarati (2004) and Shrestha (2020), the VIF is calculated using the formula below. In the first case, each of the continuous variables was regressed against the other, and finally, using the VIF command in Stata, values were not higher than 1. Thus, the continuous variables also demonstrated no collinearity problem.

$$\text{VIF} = \frac{1}{1 - R^2}$$

Once we confirmed no collinearity problems, we employed all ten variables into a Logit model (notably, binary logit) to identify the most important variables that determine extension service delivery in the study area. As shown in Table 4, out of the total ten explanatory variables hypothesised in this study, four important variables, such as land size, integrated extension service delivery, extension delivery approach and demonstration, significantly influenced extension service delivery in the study area.

However, before detailing the variables, it is crucial to interpret indicators of how the model is good before interpreting the explanatory variables. Firstly, through the classification table, the correct predictions of all the samples used were 90%. In contrast, the sensitivity (correct prediction of satisfied households) is 79.49%, and the specificity (correct prediction of non-satisfied households) is 95.06%. In this study, the chi-square model was also used as one of the indicators to assess how good the model is. To this effect, the model chi-square, specifically the omnibus tests of the model's coefficients value is 91.93 on 10 degrees of freedom, which is highly significant beyond 0.000 level, signifying that the explanatory variables used in the binary logistic regression have joint significant importance in predicting the households' evaluation of the successes of agricultural extension service.

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On the other hand, the Nagelkerke pseudo-R-square was used to determine how well the variables used in the model explain the data variation. In this regard, the variables employed in this study were in a position to explain 60.75 % of the variations. In other words, other variables could influence agricultural extension service determinants.

The land size was found to positively and significantly influence ($p<0.05$) agricultural extension delivery services. A unit increase in land size per hectare increased the access to the extension delivery service by 0.0967. Similar studies also agree that having larger land size would motivate farm households to adopt land-enhancing technologies and, therefore can increase their engagement with extension services (Assefa & Gezahegn, 2010; Hazem et al., 2021; Hu *et al*., 2022).

At the same time, integrated extension services[5] delivery was found to positively and significantly influence agricultural extension services at a 5 % significance level of less than 5% ($p<0.05$). Keeping other factors constant, farmers who received integrated extension service have been found to have extension service satisfaction, which is higher by a factor of 0.496 or 50% than those who weren't exposed to integrated extension service. The possible reflection for this variable is that an integrated approach can help farmers access multiple agricultural services that expand the choice and benefits of farmers in extension service, thereby increasing their satisfaction with the current extension services delivery.

The farmers' perceived approach to extension service delivery, whether participatory or not, was also found to positively and significantly influence the success of agricultural extension services at less than a 1% significant probability level ($p<0.01$). Participation in this study was measured in terms of farmers' involvement in the planning, implementing and evaluating the extension service process. Holding other variables constant extension delivery approach alone influenced the success of agricultural extension service by the factor of 0.734 or 73 % if it is delivered in a way that can participate farmers at all levels of extension services activities. As expected, participation is the basic instrument to bring farmers into the mainstream of extension service programs as it creates an opportunity for farmers' real problem identification. A study conducted in Ghana confirmed that the lack of farmers' involvement in extension service

[5] Integrated extension service here refers to the extension service delivery that departs from a single commodity approach but instead combines broader agriculture and rural livelihood

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delivery is the country's major problem (Asiedu, 2013; Hazem et al., 2021). In this regard, the focus group discussion conducted in Dembia and Metema revealed that farmers only trust what they see in practice. However, it is also understood that such practical exposition of farmers to new activities and technologies is a very tiresome task that can't be achieved given the meagre remuneration and low incentives for development agents.

On the other hand, participation in demonstration sites has been found to positively and significantly influence the success of agricultural extension services at a 1% significant probability level ($p<0.1$). Engaging farmers in demonstration activities increased satisfaction by 0.7012 (70%) while variables were held constant.

TABLE 4: Determinants of Extension Services Delivery in the Study Area

Variables	dy/dx	Std. Err.	Z	P>|z|
APPROACH	.7341844***	.12506	5.87	**0.000**
FIELDDAY	.2446288	.15725	1.56	0.120
FOLLOW-UP	.06584	.10828	0.61	0.543
HHLOCT	.0005906	.00125	0.47	0.636
INTEGRATION	.4965424**	.16721	2.97	**0.003**
CREDIT	.2042154	.19686	1.04	0.300
DEMO	.7012143***	.1158	6.06	**0.000**
EDU	.0139317	.01578	0.88	0.377
AGE	-.0005011	.00553	-0.09	0.928
LANDHOLD	.0967411**	.04725	2.05	**0.041**

Nagelkerke pseudo R-square (%) = 60.75 %

Correct Prediction of all samples (%) = 90.00%

Correct Prediction of satisfied (sensitivity) (%) = 79.49%

Correct Prediction of Non-satisfied (specificity) (%) = 95.06%

Note that: **, *** represent significance levels at 5 % and 1% respectively

On the other hand, even though the variable Development agents (DA) follow-up was found to have a positive and non-significant influence on satisfaction, our focus group discussion revealed that farmers who received continuous follow-up were highly satisfied by the extension service. This can be connected to the continuous nature of technology adoption from awareness creation to the final acceptance and utilisation; farmers require continuous follow-up from

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development agents from immediate consultation and communication. In line with this, the study by Elias et al. (2015) has shown similar results confirming the positive and significant effects of farmers' frequent exposure to development agents.

4. CONCLUSION AND THE WAY FORWARD

In this study, two primary research objectives have been critically analysed. In terms of approach, a mixture of quantitative and qualitative methods was utilised to come up with the following conclusions and recommendations. Firstly, the study boldly identified the major challenges of agricultural activities in the study. These are a low input supply level, higher input prices, shortage of grazing land, and low land productivity. Secondly, the study further identified the bottlenecks to the effectiveness of the extension service delivery. These include poor functioning of farmer training centres, a top-down approach, limited capacity of development agents, and poor infrastructure. Despite this, the study roughly assessed the existing extension activities in agricultural input utilisation, soil and water management, marketing extension, meteorological extension, and livestock extension, which were in line with the major challenges. It is concluded that much of the extension service is concentrated on fertiliser distribution, ignoring the other very important services for improving the agricultural sector.

Based on the results of this study, it is recommended that comprehensive extension planning from input, natural resources management, marketing, and meteorological information be used to gauge the multiple facets of agricultural production challenges in the study area. Moreover, extension services should be designed based on local problems and challenges, with intimate interaction with the farmers, to design relevant and problem-solving technologies rather than using the one-size-fits-all approach.

The study tried to analyse the important determinant factors of extension service delivery. The binary logit econometrics model revealed that, most importantly, household characteristics, notably farm size, organisational efforts such as consistency of development agent's follow-up, integrated approach and demonstration arrangements positively and significantly influenced extension service delivery. At the same time, qualitative responses from focused group discussions added that the low capacity of extension personnel, poor incentives, and lack of commitment by the side of farmers are the other factors that strongly influence extension

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service delivery in the study area. Therefore, appropriate interventions should be designed to address the farmer, the capacity of extension personnel, motivational incentives, and the extension approach itself.

In this study, it is safe to conclude that the existing extension service delivery practices are very low due to multiple and interlocking challenges which demand concerted efforts at different levels. Agricultural and rural development offices at all levels should revisit the service delivery approach to accommodate multiple stakeholders for extension services such as meteorological, marketing and livestock extension. At the same time, there should be a consistent follow-up of farmers at the initial technological attachments to save them from dejection and rejecting the technology. Thus, improving the existing development attachments with the farmers should be further strengthened to improve extension service delivery. The study also confirmed the relevance of the practical attachment of farmers through field days and demonstrations. Thus, field days should be arranged in a participatory way so that every segment of the agricultural society can benefit from practical observation. On top of that, there is a need to consider private agricultural extension service delivery to circumvent the problems of top-down implementation.

5. DISCLOSURE STATEMENT

The authors declare that they have no competing financial or non-financial interests.

6. ACKNOWLEDGEMENT

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Appendix I

Appendix I A: Correlation coefficient among discrete variables

	approach	filedday	followup	integrg	credit	demon
approach	1.0000					
filedday	-0.0424	1.0000				
followup	0.0547	0.0812	1.0000			
integrg	0.1612	0.0182	0.0518	1.0000		
credit	0.1256	-0.0632	-0.0539	-0.0095	1.0000	
demon	0.2741	-0.1108	0.2789	0.2077	0.0917	1.0000

Appendix I B: Variance inflation factor for continuous variables

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. vif
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Variable	VIF	1/VIF
landsize	1.06	0.946574
hhlock	1.04	0.963679
age	1.02	0.981503
Mean VIF	1.04	

Appendix IC: Community based wealth ranking for each district

Wealth ranking	Demiba	Wogera	Metema
Rich (Well-off)	More than pair of oxen, 4 hectares of land, have 1 donkey and goats and sheep, no food shortage, have surplus produces	Pair of oxen, 1 donkey, 3 hectares of land and have goats and sheep's, no food shortage, have surplus produces	3 pairs of oxen, 1 donkey, 10 hectares of land and have goats and sheep's, no food shortage, have surplus produces
Medium	Pair of oxen, Pairs of oxen, 1-3 hectares of land, 1 donkey, 1 hectares of land have	Pairs of oxen, 1 donkey, 0.5 -2 hectares of land, have no food	5-9 hectares of land, have goats and sheep, have no food

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	no food shortage throughout the year	shortage throughout the year	shortage throughout the year
Poor	Have land less than 1 hectare, have no other assets, faces food shortage throughout the year	Have land less than 0.5 hectare, have no other assets, faces food shortage through the year	Less than 5 hectares of land, have no pairs of oxen, donkey and small ruminants, faces food shortage through the year

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Market Orientation in Agricultural Extension and Advisory Services Approaches: Experiences from Service Providers and Farmers in Central Malawi

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ABSTRACT

Market-oriented extension and advisory services enable linkages among actors within agricultural value chains, which is necessary for commercialisation. The study analysed the market orientation of extension approaches employed by various service providers. Qualitative methods were used to collect data from 12 key informants and 84 farmers through 11 focus group discussions. The study targeted extension providers from public and private sectors and non-governmental and farmer-based organisations. We found that extension service providers employ the commodity specialised approach, farmer business school, project approach and smallholder horticultural empowerment and promotion approaches to reach farmers. There are differences in the market-orientation rating of the approaches. Unlike other service providers, public service providers perceived capacity gaps in all areas. The main challenges faced include inadequate funding, high extension worker-to-farmer ratio, poor policy environment and weak legal frameworks, lack of trust and information sharing among actors, poor coordination among extension service providers and actors, and high illiteracy levels among farmers. We conclude that most approaches are not fully market-oriented. Service providers of extension and advisory services should design and implement tailored market-oriented extension and advisory services for farmers commercialising to different levels.

Keywords: Agricultural Extension, Market-Based Extension, Service Providers, Rural Malawi

1. DEFINITION OF PROBLEMS

Agricultural extension and advisory services (AEAS) are "all the different activities that provide the information and the services needed and demanded by farmers and other actors in

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a rural setting to assist them in developing their own technical, organisational and management skills and practices to improve their livelihoods and well-being" (GFRAS, 2012). AEAS plays the role in provision of information, technologies and innovations to help farmers make informed decisions to improve their productivity, food security, and livelihoods (Baloch & Thapa, 2018; Nordin & Höjgård, 2017; Ragasa & Niu, 2017; Olagunju & Adesiji, 2013; Ali-olubandwa, Kathuri & Wesonga, 2011; Waddington, Snilstveit, White & Anderson, 2010; Birkhaeuser, Evenson & Feder, 1991). There are arguments about AEAS not adequately achieving the roles because of the capacity of service providers, low funding, trying to do too much with little resources, and other policy and structural challenges (Masangano & Mthinda, 2012; Ponniah, Puskur, Workneh, & Hoekstra, 2008; Anderson & Feder, 2003). Others have argued that one of the difficulties in pinpointing the impact of AEAS is that it requires a conducive policy environment and other support services (Anderson & Feder, 2003). For example, AEAS provides farmers with knowledge and skills to produce, but production can only happen if farmers have access to productive resources, including land.

AEAS has struggled to keep up with the farmer's demand for new skills in a rapidly changing environment. With farmers' need to diversify and commercialise, extension workers must have skills in various crops, livestock and livelihood activities to adequately assist farmers (Van den Ban & Samanta, 2006). Additionally, with the growing calls to commercialise agriculture, AEAS are at the centre of driving this commercialisation agenda to provide the necessary capacity for different actors along the value chain (Scott, 1998). Commercialisation is a shift from subsistence farming to commercial farming (Von Braun & Kennedy, 1994), with the assumption that more engagement with both input and output markets is a positive step towards economic growth (Carletto, Corral & Guelfi, 2017), especially for countries whose economy is based on agriculture such as Malawi. Others have argued that AEAS has not adequately adapted to the changing needs of farmers as it has mainly remained production-oriented in messaging, designing, and programming, which limits the benefits farmers can get (Gebremedhin, Hoekstra &Tegegne, 2015; 2006a; 2006b; Gebremedhin, Jamaneh, Hoekstra & Anandajayasekeram, 2012). More recent literature posits that AEAS has struggled to account for socio-political factors in the delivery of extension services (Cook, Satizabal & Curnow, 2021).

AEAS providers implement different extension approaches to achieve their objectives. The extension approach is a course of action that informs, stimulates and guides the structure, leadership, programme, resources and linkages within an extension system (Kaur & Kaur, 2018). Studies have argued that the focus for AEAS should not only be on increasing agricultural production but also on enhancing incomes among rural households, hence the need for AEAS to be market-oriented to respond to the changing demands of farmers (Christoplos, 2010; Kahan, 2014; Musa Gwary, Makinta & Wakawa, 2019; Van den Ban & Samanta, 2006) However, the extent to which these extension approaches are market-oriented needs to be investigated. Gebremedhin *et al*. (2012) define market-oriented extension and advisory services (MOEAS) as total efforts that extension workers put in advising and supporting farmers to produce profitable market-oriented commodities and adopt appropriate technologies and practices, collecting and communicating market-oriented information, identifying profitable markets and buyers and linking farmers to buyers, building marketing capacity among farmers, and facilitating organisation of farmers to conduct collective marketing of their produce. A market-oriented extension approach enables production and provides market information, including enabling market linkages among different actors within the agricultural value chains and views farming not only as a production unit but as an enterprise (Gebremedhin *et al*., 2012). The study's main aim was to determine the market orientation of AEAS in Malawi through a critical analysis of the different stakeholders' approaches. Specifically, the study analysed the market orientation of the extension and advisory services, conducted mapping of actors and stakeholders working with targeted extension and advisory service providers, analysed capacity gaps of extension and advisory service providers to deliver market-oriented extension and advisory services (MOEAS); and identified challenges in the implementation of MOEAS. The study contributes to the body of knowledge on extension approaches used in the delivery of extension services and in shaping policy and practice in the design and implementation of extension approaches through an understanding of the impacts, gaps and challenges.

2. METHODOLOGY

2.1. Study Site

The study was conducted in Dowa (Lisasadzi Extension Planning Areas (EPA), Lilongwe (Mitundu and Ukwe EPAs), and Mchinji (Chiosya EPA) districts in central Malawi following

specific extension service providers employing particular extension approaches targeting different groups of farmers.

2.2. Data Collection Methods

We collected both primary and secondary data. Secondary data involved reviewing the extension approaches in Malawi, including extension policy, the National Agricultural Extension and Advisory Services Strategy (NAEASS), reports from public, private and civil society extension service providers and journal articles. The key output of the desk review was documentation of agricultural extension approaches being implemented in Malawi, their rationale, mandate, underlying assumptions, theoretical underpinnings, policy alignment and implementation strategies. We used these themes to evaluate extension approaches as guided by Swanson, Bentz and Sofranko (1998). Through the desk review, the study selected the extension approaches to establish their market orientation theoretically (based on desk review) and practically (based on interviews). The study was grounded on a constructivist epistemology, which recognises multiple realities based on the perspectives of different social actors. The research used a qualitative case study approach to allow AEAS providers' and farmers' perspectives to emerge, where focus group discussions (FGDs) and key informant interviews (KIIs) were the key research strategies. The researchers had a moderated interaction with AEAS providers and farmers. They collected data on their knowledge, experiences, beliefs, perceptions, and attitudes on the market-orientedness of agricultural extension approaches in Malawi. FGDs enable people to ponder, reflect, listen to the experiences and opinions of others, and interact (Onwuegbuzie, 2009; Krueger & Casey, 2000).

2.3. Sample Size and Sampling Techniques

Multistage purposive and snowballing sampling techniques were used to select the stakeholders to participate in the study. The first stage involved the identification of extension approaches that are used in Malawi. This was done through a literature review and expert consultation. The approaches include the general agriculture extension approach, commodity specialised approach, farmer field school, farmer business school, model village, lead farmer approach, project approach, smallholder horticulture empowerment and promotion (SHEP) approach and household approach. Through consultation with government extension officials on the approaches that are commonly used and have wide coverage, we selected the government extension approach, commodity specialised approach, farmer business approach,

and SHEP approach. The second stage involved selecting extension service providers and employing the approaches from different types of extension service providers. The choice of the providers was also informed by the value chains they are promoting. Their importance guided our interest in the value chains regarding food and income provision and diversification, i.e. maize, groundnuts, tobacco and livestock. The following service providers were selected based on how active they are and their coverage: public- the Department of Agricultural Extension Services (DAES), private- Agricultural Research Extension Trust (ARET), NGOs- HEIFER International and farmer-based organisation- National Smallholder Farmers Association of Malawi (NASFAM). The third stage involved selecting study participants using the purposive method to target those with experiences and knowledge crucial to the study. The study collected data from 12 national, district, and field key informants. We also gathered data through 11 FGDs involving 84 participants (See details in Table 1). The limitation of the study is that we did not collect data on the interests and needs of farmers regarding commercialisation so that extension services can be customised towards farmer's needs.

TABLE 1: Selection of Case Studies

Approach	**National level (KII)**	**District level (KII)**	**Field Level (KII)**	**FGD participants**	
				Men	**Women**
DAES General agriculture extension approach SHEP approach	Senior Agribusiness Officer	Agribusiness officer – Lilongwe East Mitundu EPA	Agricultural Extension Development Officer	8	10 9
General agriculture extension approach Farmer business school		Agribusiness officer- Lilongwe West UKWE EPA	Agricultural Extension Development Officer	6	8 7
ARET Commodity specialised approach	Extension services coordinator	Land husbandry officer	Extension agent	7	0

		Lilongwe	Nsaru, Lilongwe		
NASFAM Business oriented approach Farmer-to-farmer approach	Farm services coordinator Business and marketing development manager	-	Field officer Lisasadzi EPA, Dowa	6	9
HEIFER International Commodity specialised approach Project Approach	Director of Programs	-	- Chiosya EPA, Mchinji	6	8
Total	5	3	4	33	51

2.4. Data Analysis

This study adopted the constant comparison analysis approach developed by Glaser (1965). The analysis was done using audio-recorded transcripts and later manually transcribed. Transcript-based analysis is one of the most methodical and time-consuming styles of qualitative data analysis (Onwuegbuzie, 2009). The study used five steps to analyse the data. The first step involved meticulously reading and reviewing the transcripts of all FGDs and KIIs conducted in the four organisations (DAES), ARET, NASFAM and HEIFER International, to acquaint researchers with the subject matter. The second step was to categorise themes. The researchers identified four themes: 1) Actors in MOEAS, 2) Capacity of the MOEAS providers, 3) Challenges/barriers in implementing MOEAS, and 4) Market orientation of the approaches. Accordingly, in the third stage, the researchers developed a colour code for content related to the four themes. The fourth step was colour-highlighting and categorising the explanations that reverberated with each theme. The participants' explanations identified for each theme were then listed in an Excel sheet. The researchers then studied all the explanations and additionally classified these explanations into subclasses. For instance, all the explanations supporting theme one were sorted and categorised under that theme (Krueger & Casey, 2000). At this stage,

the data was ready for analysis. The results were linked to the research objectives and then mapped and interpreted (Krueger & Casey, 2000).

3. FINDINGS

3.1. Characteristics of Study Participants

TABLE 2: Demographic Characteristics of the Respondents

Variable	DAES (n=49)		NASFAM (n=12)		ARET (n=7)		HEIFER (n=16)		TOTAL % OF RESPONDENTS (n=84)
Sex of respondent	**Freq**	**(%)**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Male	15	(30)	3	(25)	7	(100)	8	(50)	**33 (39)**
Female	34	(70)	9	(75)	0	(0)	8	(50)	**51 (61)**
TOTAL	**49**	**(58)**	**12**	**(14)**	**7**	**(8)**	**16**	**(19)**	**84 (100)**
Marital status									
Unmarried	6	(12)	4	(33)	0	(0)	2	(12)	**12 (14)**
Married	43	(88)	8	(67)	7	(100)	14	(88)	**72 (86)**
TOTAL	**49**		**12**		**20**		**20**		**84 (100)**
Education level									
None	6	(12)	1	(8)	0	(0)	4	(25)	**11 (13)**
Primary	38	(78)	5	(42)	4	(57)	9	(56)	**56 (67)**
Secondary	5	(10)	6	(50)	3	(43)	3	(19)	**17 (20)**
TOTAL	**49**		**12**		**7**		**16**		**100.0%**
Household Head									
Male	43	(88)	8	(67)	7	(100)	14	(88)	**72(86)**
Female	6	(12)	4	(33)	0	(0)	2	(12)	**12(14)**

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TOTAL	**49**	**12**	**7**	**16**	**(100)**
Age (Years)			***Mean***		
	47	44	48	55	

Eighty-four smallholder farmers participated in the study, comprising 33 (39%) men and 51 (61%) women. These farmers were organised in groups and engaged in different commercial agricultural enterprises supported by different organisations. Out of the 84 farmers, 49 farmers (15 men and 34 women) participated under DAES, 12 farmers (three men and nine women) participated under NASFAM, seven farmers (all men) were involved through ARET, and 16 farmers (eight men and eight women) participated under HEIFER International. The 49 farmers that DAES supported came from two groups-- Tikondane Club (35 members) from Lilongwe West specialising in groundnut production, and Farmer Business School (14) from Lilongwe East producing groundnuts—the sampled households comprised 86% male-headed and 14% female-headed households. Most of the respondents were married (86%). Most respondents were primary school dropouts (67%), followed by secondary school dropouts (20%) while 11% never attended primary school. The mean ages for the participants were as follows: DAES 47 years (25 min- 63 max), ARET 44 years (27 min-75 max), HEIFER International 48 years (30 min-74 max), NASFAM 55 years (37 min- 61 max).

3.2. Market Orientation of Extension and Advisory Service Approaches

Market orientation rating was done using the Likert scale to assess the alignment of the approach to market-oriented extension principles, including resource-based, business principles, commodity development approach, based on value chain framework, and bottom-up and participatory (Gebremedhin *et al*., 2012). We asked extension staff to determine how well the approach aligns with the extension principles. Farmers were asked how well the approach helped them to take farming as a business. The analysis shows that all service providers are implementing market-oriented extension approaches, but the degree to which these approaches are consistent with market-oriented principles differs. Some are more market-oriented than others. Table 3 summarises the findings on the market orientation of the approaches.

TABLE 3: Market Orientation of Extension Approaches

Organisation	Approach	Market orientation rating	Reasons for rating
DAES	SHEP	4	SHEP has a principle that promotes 'growing to sell,' it also improves farmers' skills in producing and marketing the produce. However, it is not rated very best because it is new, and we have yet to see its full impact.
	FBS	3	Yes, it teaches farmers the principle of farming as a business. The approach has been there for a long time, but farmers are still facing challenges to improve their livelihoods. There is low horizontal and vertical mobility of livelihood activities.
ARET	Commodity specialised approach	3	In as much as it helps to concentrate on one commodity and improve production, which increases produce for sale, the approach is top-down in nature and does not consider the needs of farmers.
NASFAM	Commodity specialised approach	4	The approach under NASFAM helps farmers access inputs, markets and extension and advisory services, which are crucial in market-oriented extension and advisory services. It also ensures adherence to international quality standards for groundnuts to sell at international markets.
Heifer international	Project approach	3	Despite the approach being implemented quickly, farmers benefited from receiving dairy animals and extension and advisory

		services to take dairy farming as a business. Farmers also benefitted from physical infrastructure (building and cooling equipment)
Commodity specialised approach	3	Focusing on the dairy value chain's production and marketing activities helps farmers get the most benefits from extension and advisory services.

Note: 1=worst, 2=worse, 3=medium, 4=best, and 5=very best

The analysis shows that the SHEP approach implemented by DAES and the commodity-specialised approach implemented by NASFAM have the best market orientation rating because they adhere to principles of market-oriented extension. However, SHEP was considered the best because it applies the bottom-up and participatory principle, unlike the commodity-specialised approach, and because of its impact on farmers. Some of the effects that the SHEP approach has on farmers include improved income through producing more and selling more, group selling; accessing cheap quality seeds through collective buying; increased production through following recommended agronomic practices; improved food security through producing more and having access to income; engagement in off-farm businesses including grocery store; educating children; accumulating assets (e.g. livestock, oxcarts).

> *"We really make some profits if we have quality products. For example, at one point at Mitundu market, tomatoes were fetching different prices depending on quality. High-quality tomatoes were sold at 3.46 US$ per bucket, while low-quality tomatoes were sold at half that price (1.73 US$) per the same bucket. This is an indication that no matter how much large the yield is, if the product is well taken care of and is of high quality, it will fetch a lot of profits."* FGD with women, Kabambe village, Mitundu EPA.

3.3. Actors Working with Service Providers in Implementing MOEAS

The study mapped service providers and actors in the implementation of MOEAS. Figure 1 presents a summary map of the providers and the actors they work with in implementing MOEAS. Findings demonstrate various actors that work with DAES, HEIFER, ARET and NASFAM, falling in the categories including financial institutions, smallholder farmers,

produce buyers, seed and input suppliers, supermarkets, capacity building and transportation. Implementing decentralised and pluralistic policies in providing extension and advisory services has led to increased availability of actors providing extension services to farmers in most developing countries, including Malawi. Notably, among the actors, DAES networks more with HEIFER International than NASFAM while having no interactions with ARET. ARET, HEIFER International and NASFAM do not interact as they implement MOEAS. This demonstrates that HEIFER International gets more support from government extension workers in delivering MOEAS than NASFAM and ARET. What is clear about the providers is that they have a shared goal of improving the livelihoods of smallholder farmers by developing their farming business capacity. However, inadequate and weak interactions among them may lead to differences in their knowledge and capacity regarding the skills or knowledge required to promote MOEAS. Lack of shared knowledge and practice among providers may contribute to the delivery of uncoordinated and duplication of efforts, thereby limiting the effectiveness of MOEAS delivery (Lamm, Masambuka-Kanchewa, Lamm, Davis, & Nahdy, 2020). Enhancing coordination and collaboration among the service providers is of utmost importance if their efforts to improve farmers' business capacity are to be fruitful.

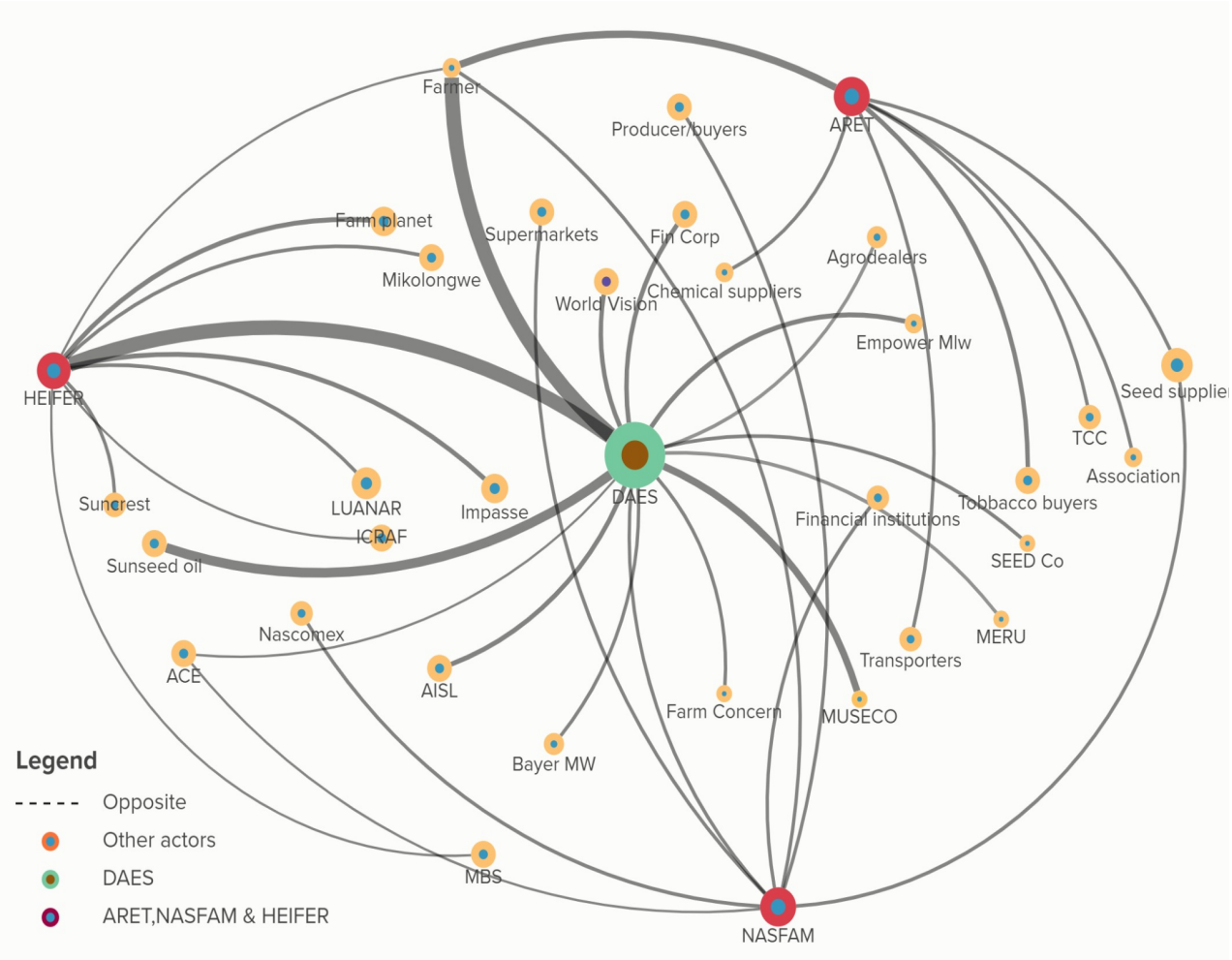

FIGURE 1: Actors Networks in the Provision of Market-Oriented Extension and Advisory Services

3.4. Extension Service Providers' Perceptions of Their Capacities

We asked extension providers to rate their capacity in the identified 14 areas (See Figure 2). The themes were determined based on FAO's guidelines for assessing organisation's capacities (FAO, 2022). We identified common and divergent views from the responses based on content analysis. Figure 2 the perceptions of capacity gaps in each of the organisations engaged. This study has determined that the four organisations perceived capacity gaps in five aspects required for supporting market-oriented extension and advisory services. The gaps identified were related to networking, resource mobilisation, knowledge management and communication, governance, monitoring, evaluation and learning systems.

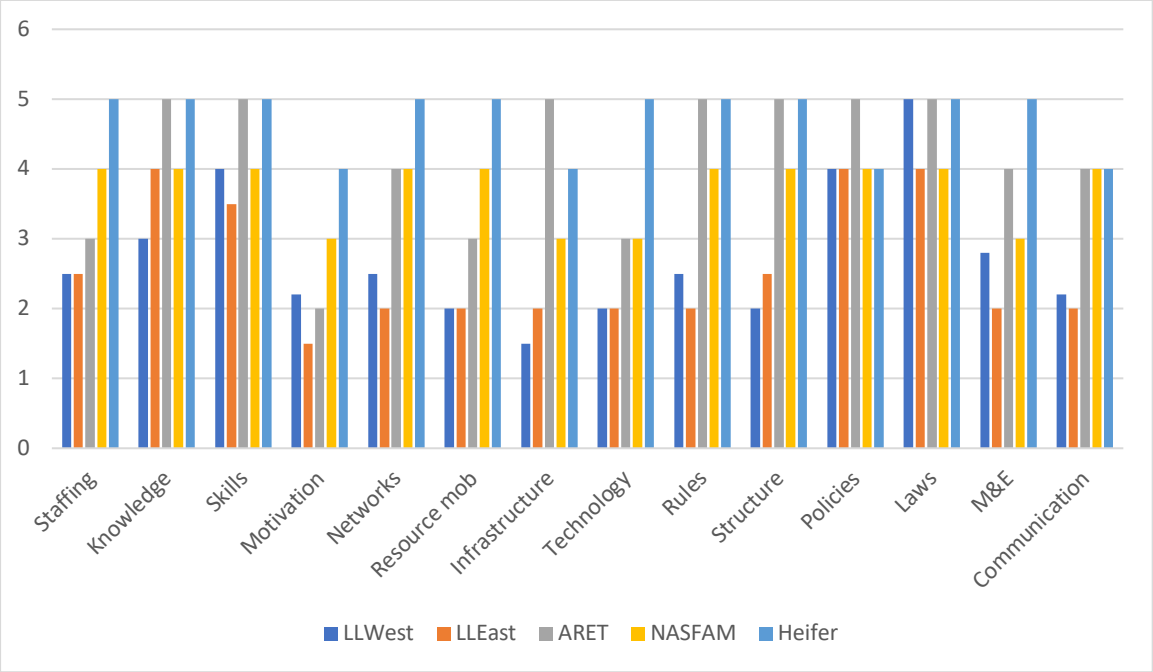

FIGURE 2: Perceptions on the Capacity of Service Providers in Supporting MOEAS

Notes: Scores from a scale of 1 to 5 (0= no capacity, 1= very low, 2= low, 3=medium, 4=high, 5=very high).

The analysis is clear that DAES perceived capacity gaps in all the areas, and Heifer perceived the least capacity gaps. This means that the delivery of AEAS is more challenging for DAES than for other providers. The implication is that since DAES has the largest coverage, many farmers receive poor and inadequate AEAS because of its capacity gaps. This could also impact farmers' benefits from extension and their participation in farming and the market. Others have reported capacity challenges in public extension, including Belay & Abebaw (2004) in Ethiopia and Adejo, Okwu & Ibrahim (2012) in Nigeria.

3.5. Challenges in the Implementation of MOEAS

The study analysed the challenges that AEAS providers face in implementing MOEAS. Table 4 presents the challenges that extension service providers mentioned.

TABLE 4: Challenges in the Provision of MOEAS

Challenges	Explanation/quotes
Lack of availability of policy documents and weak legal	*"The government departments sometimes they are a bit slow, we work at a different pace. It's a challenge when we align to what we want to achieve and the*

frameworks to guide implementation of MOEAS	*support that we get from the government is poor. For example, the review of Milk Act and the review of the board has taken two years for the government to set up the board after the recommendations were made."* KII with Director of Programs Heifer International.
Poor information sharing among stakeholders	*"…there are forums at district level where actors share ideas and issues…. So somehow, it is working, but it needs improvement.* KII with Business and Market Development Manager, NASFAM. *"The dairy processors keep information, they do not share the information easily to protect their data. The information is there but it's not released."* KII with Director of Programs Heifer International.
Poor access to inputs among farmers in rural areas	*"Fertilizer and other inputs are very expensive for us to manage."* FGD with tobacco farmers in Nsalu, Lilongwe.
Low production levels among farmers which affect their market participation and bargaining power	*"…last season, a good number of farmers had their tobacco affected by heavy rains which made the production to be very low. We were supposed to produce about 140 million tonnes, but we had around 70 million. This is happening frequently because of the impacts of climate change… the rains may be heavy or scanty". KII with Extension agent, ARET, Nsalu, Lilongwe.* *"Malawi Dairy Industries started buying from us in 2015 when the cows started producing milk. Then Lilongwe Dairy came, but because our milk production went down due to cattle diseases…, we were not supplying enough, both companies stopped buying from us….they required 800 litres/day but we could only supply 300 litres/day".* FGD with

	farmers-milk bulking group, Mchinji dairy cooperative, Chiosya EPA.
Poor mobility among frontline extension workers	*"Another challenge is the issue of mobility. Many extension workers use bicycles which makes it difficult to reach out to many farmers as bicycles easily get broken down. The extension workers would love to have motorbikes to ease the mobility problem. This mobility problem is at both EPA and district levels. For instance, we only have one vehicle to cater for different departments in terms of supervision, follow-ups and trainings which makes it a challenge for us to reach out to many farmers."* KII with field officer ARET.
Inadequate funding to implement activities	*"Mostly we don't have enough money for farming so we look for crops that will not require a lot of inputs, such crops are groundnuts, soybeans, sweet potatoes. These are the crops that do not require a lot of inputs as compared to maize, tobacco, and Irish potatoes."* Male participant, Kabambe village, Mitundu EPA, DAES.
High illiteracy levels among farmers	*"The challenge that we face with farmers is that it is difficult for them to understand the extension approaches we teach them. Maybe it is due to levels of literacy of the farmers. This makes the level of adoption of the extension approaches to be very slow. For instance, you find that something that we taught the farmers several years ago, it is taking a long time for them to understand it. Maybe it may also not only be an issue of the problem of literacy but also their beliefs which makes farmers results in slow adoption of the extension approaches we teach*

	them." KII with Trade officer, NASFAM country office.
Reluctance to change mindset towards farming for business among farmers.	*"Most of the farmers do not want to bulk their produce to sell as a group, they are afraid of the unknown. So, by training them, we would like to change their mindset to produce for the market in addition to producing for consumption…*" KII with Agricultural Extension Development Officer (AEDO), DAES, Mitundu EPA. *"Farmers lack the patience for them to remain in the group until a market is identified. They rush to sell to other unprofitable markets to get quick cash. This could be because farming is their only source of income".* KII with AEDO, DAES UKWE EPA, Lilongwe. *"…they (farmers) have their own way of doing farm activities and when you try to help them, there is that kind of resistance to implement new ideas.* KII with Extension agent, ARET, Nsalu, Lilongwe
Lack of trust among farmers hinders collective marketing	*"The other problem is that, though we have a warehouse where farmers can group and store together their groundnuts and soyabeans, they still don't trust anybody, to look after the commodity before selling it and later on when the weights differ due to moisture loss, they think something fishy happened to their produce."* KII with Association Field Officer, NASFAM, UKWE EPA, Lilongwe.
Political influence on marketing of produce	*"Government sets a minimum price but you will find that some buyers will still be buying produce from farmers below the minimum price. But there are no enforcement measures. At district level there is nothing we can do to do the enforcement of such*

	much as we try our best to talk to buyers to honour their promises to farmers. For example, we may talk to buyers pertaining to these issues, they make their own promises, but they end up not fulfilling those promises. Farmers are made to wait for payment as time elapses until the next production season". KII with Agribusiness officer, DAES Lilongwe West.
High extension worker-to-farmer ratio	*"The first challenge we have is the poor extension worker to farmer ratio. There are few agricultural extension workers against a large number of farmers as a result not every farmer is reached out to. That is, there is low coverage"* KII with Agribusiness Officer, DAES, Lilongwe East.
Poor coordination among actors	*"The major challenge is poor coordination. There is a lack of coordination whereby sometimes we don't know how some actors are implementing their extension concepts which bring about other challenges. For instance, this lack of coordination may result in the farmers getting contradictory messages from the actors and us, thereby confusing farmers."* KII with Agribusiness Officer, Lilongwe West. *"…we need to harmonise extension approaches that are used by different players so that we can speak the same language not to confuse an ordinary farmer."* KII with Farm Services Coordinator, NASFAM.

Some of the challenges include: lack of availability of policy documents and weak legal frameworks to guide the implementation MOEAS; lack of information sharing among stakeholders which affects feedback to farmers for them to make informed decisions; trustto inputs in rural areas; low production levels among farmers affecting their market participation and bargaining power; poor mobility in terms of transport infrastructure (vehicles) and resources (fuel) among frontline extension workers affecting their work; inadequate funding to

implement activities; high illiteracy levels among farmers hindering their understanding and interpretation of extension messages and technologies; some farmers are reluctant to change their mind set towards farming as a business of risk aversion; it is difficult to promote collective marketing among farmers because of lack of trust; it is difficult to control the political influence on marketing of produce, hence the marketing environment is not conducive to benefit farmers. There is a huge extension worker-to-farmer ratio, which affects the effective implementation of activities. Some of these challenges have also been observed by other authors (Lukhalo & Zwane, 2022) in South Africa, who observed that the budgetary allocation and public expenditure to farmer programmes was insufficient. In Pakistan, Yaseen, Shiwei, Wen and Hassan (2015) identified adequate funding, poor transportation and large jurisdiction areas as challenges extension workers faced.

4. CONCLUSIONS

This study investigated the extent to which agricultural extension approaches are market-oriented. Other studies have also argued that AEAS has limited contributions towards agricultural productivity and commercialisation. AEAS in Malawi are necessary but not enough to enable enhanced productivity and drive commercialisation among smallholder farmers because of other factors beyond the control of agricultural extension. The extension approaches exhibit different levels of market orientation. Most of them lack complete market orientation, impacting targeted farmers' benefits and impeding providers' efforts to advance the commercialisation agenda. AEAS providers have inadequate and weak networks, which affects knowledge and capacities to support MOEAS and the delivery of coordinated efforts, thereby limiting the effectiveness of MOEAS. Different providers have varying gaps in capacities to promote MOEAS. Of concern is the government (DAES), which has huge capacity gaps and is the leading service provider. The implication is that most smallholder farmers accessing extension services from DAES are less likely to benefit from MOEAS.

5. RECOMMENDATIONS

Service providers of AEAS should design and implement tailored MOEAS for farmers who are commercialising at different levels. The government, through DAES, should champion coordination and collaboration of MOEAS providers if their efforts to improve farmers' business capacity are to be fruitful. Further research is needed to gain a deeper understanding

of the interests and needs of farmers regarding commercialisation so that extension services can be tailored to farmers' needs.

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Leguminous Cover Crops Increase the Biomass and Nutritive Value of Grasses in South African Soils: A Review

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ABSTRACT

Due to the expansion of farming, many agricultural systems now depend more on chemical pesticides and inorganic fertilisers to boost farm output. Leguminous cover crops are used to improve soil fertility and to increase nitrogen availability for crop production. This review focuses mainly on evaluating the role of leguminous cover crops on soil's physical, chemical and biological properties. Furthermore, it focuses on the role of cover crops in crop biomass, grass nutritive value and crop-livestock grazing systems. This review used the Web of Science, Scopus and Google Scholar databases (accessed between January 2003 and December 2022). To find publications in the scope of the study, the authors combined different groups of keywords. The reviewed literature revealed that leguminous cover crops significantly increase yield due to an increase of nitrogen through nitrogen fixation. In addition, leguminous cover crops boost the forage's nutritional value, lowering feed costs and increasing livestock productivity. As a result of these findings, farmers can reap the benefits of leguminous cover crops in various ways, including enhancement of soil health, biomass, yield and reducing overall production costs.

Keywords: Biomass Production, Grass Nutritive Value, Legumes, Livestock Production, Soil Properties

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1. INTRODUCTION

The intensification of agriculture has led to many agricultural systems relying more on inorganic fertilisers and chemical pest control methods for increased productivity on farms (Altieri *et al.,* 2012). However, inorganic input costs are growing, and land degradation and environmental pollution have become a concern (Steinfeld *et al.,* 2006). As a result, the demand for affordable agricultural practices is growing (Ricker-Gilbert, 2020). Soon, the sustainability of crop production will rely on managing primary resources (soil and water), which will be directed towards environmentally friendly practices, especially for the topsoil. The term 'topsoil' refers to the soil's organic matter and nutrient-rich component in the first 5 to 20 centimetres (Mills & Fey, 2003). The topsoil is crucial for plant growth due to its high fertility, moisture retention, support for root systems and microbial activity. About 60% of South African topsoil is susceptible to degradation due to losses in organic matter (Mills & Fey, 2003). Among other factors, losses in organic matter from the topsoil can be caused by intensive tillage, monocropping, overgrazing, poor crop residue management, soil erosion, and poor irrigation practices. Land degradation is one of the primary causes of low crop yields, especially among South African subsistence farmers, primarily located in marginal areas (Parwada & Van Tol, 2020). In arable land, low crop yields could be due to soil acidification, compaction, crusting, erosion, and nutrient decline. As a result, soil regenerative management strategies are required. It is a known fact that comprehensive soil preparation practices, such as tilling or mowing, combined with crop residue removal, exacerbate arable land degradation and soil deterioration by depleting soil organic matter and leaving the soil exposed to climate-related risks such as water and wind erosion (Lötter, 2017). One of the management strategies to overcome these challenges is the incorporation of cover crops within cropping systems for improved soil health and crop productivity (Ricker-Gilbert, 2020). Generally, legumes are some of the cover crops grown to safeguard and enhance soil quality (Teasdale *et al.,* 2007). They are primarily used for their ability to fix nitrogen (N) from the air and store it in nodules in their roots. Nitrogen fixation is a biological process through which atmospheric nitrogen is converted into a form that plants can utilise (Selim *et al.,* 2019). Legumes can be applied to the soil as living or dead mulch and incorporated into the soil as green manure (Teasdale *et al.,* 2007). The biological N fixation by leguminous cover crops can decrease the requirement for N fertilisers in the follow-up crop. In addition, leguminous cover crops can aid in pest and weed control in cropping systems (Baligar & Fageria, 2007).

Cover crops are commonly cultivated during the dormant season between the preceding year's primary crop and the establishment of the subsequent primary crops (Teasdale *et al.,* 2007). However, productive cover cropping necessitates planning, selecting appropriate cover crops, and planting and terminating them at the appropriate times (Roesch *et al.,* 2018). Thus, cover crops could be most beneficial if they are managed as an integral part of the cropping system rather than as an afterthought. Acceptable cover crop species that offer adequate biomass generation to protect the outermost area of the soil and introduce other advantages to enhance the production of subsequent cash crops need to be identified (Mahama, 2015). The overall objective of this paper is to summarise the prospective effect of leguminous cover crops on the increase of biomass and nutritional value of companion plants.

2. MATERIALS AND METHOD

A literature review that focused on the effects of leguminous cover crops on the biomass of grasses and nutritional value in South African soils was carried out using the Web of Science, Scopus and Google Scholar databases (accessed between January 2003 and December 2022). Additionally, reputable online repositories and institutional websites were accessed to gather relevant information. To find publications in the scope of the study, the authors combined different groups of keywords: “legumes”, “leguminous cover crops” “biomass production”, “grass nutritive value”, “soil properties”, “livestock production”, “chemical properties”, “physical soil properties", “crop integration”, “livestock grazing”, “cover crops and their success in South Africa”, “integrated crop-livestock system” and “inorganic fertilisers”. Moreover, the keywords were combined with Boolean operators (such as AND, OR) to refine the search and ensure the retrieval of relevant literature. The search results were screened based on the titles and abstracts to assess their relevance to the research topic. Non-relevant or duplicate articles were excluded at this stage. The remaining articles were selected for a full-text review. The authors also checked the references in the collected papers to broaden the search. The key findings, concepts, and insights from the reviewed literature were summarised and synthesised. The information was then used to address the research objectives, subtopics, and research gaps identified in the review.

3. POTENTIAL EFFECT OF LEGUMINOUS COVER CROPS ON SOIL PROPERTIES

Leguminous cover crops have received a lot of interest in environmentally friendly agriculture because of their ability to enhance soil properties (Fróna *et al.,* 2019). Among others, these cover crops include plants like clover (*Trifolium repens*), vetch (*Vicia sativa*), peas (*Pisum sativum*), and beans (*Phaseolus vulgaris* L.) (Fróna *et al.,* 2019). Understanding the prospective influence of leguminous cover crops on soil properties is critical for their management and maximising their uses based on their advantages. One of the possible advantages of leguminous cover crops is their capacity to improve soil structure (Devereux *et al.,* 2012). The extensive root systems of leguminous cover crops can loosen the soil, forming channels and pores that improve soil aggregation (Demir, 2020). Additionally, cover crops are a vital factor in environmentally friendly agriculture because of their unique ability to fertilise soil, prevent soil erosion, increase nutrient availability, and encourage organic matter accumulation (Adetunji *et al.,* 2020). Recognising and exploiting these effects allows farmers and land managers to use leguminous cover crops as a valuable tool to advocate environmentally conscious and productive agricultural systems (Blanco-Canqui *et al.,* 2015).

3.1. Soil Biophysical Properties

Soil bulk density, porosity, texture, water retention, and soil temperature are the primary physical soil properties that impact soil quality and are significantly affected by cover crops (Blanco-Canqui & Ruis, 2020). Some factors that influence soil's physical properties are the number of particles, particle distribution, and circulation of gases and liquids underneath the soil (Blanco-Canqui *et al.,* 2012). According to Horn and Smucker (2005), these factors collectively influence the shape and structure of the soil. Likewise, the complicated root systems of leguminous cover crops provide outstanding ground cover for improved water retention (Bergtold *et al.,* 2019) and reduce the possibility of soil erosion (Sharma *et al.,* 2018). When cover crops are harvested and incorporated into the soil, they add to the organic matter pool and improve the accessibility of additional vital nutrients (Hubbard *et al.,* 2013). Moreover, covering crops encourages microbial activity and nutrient cycling in soils and helps to improve long-term soil fertility and endurance by encouraging organic matter build-up (Steele *et al.,* 2012). Generally, cover cropping practices can assist in decreasing soil degradation, enhancing soil health, and increasing productivity in the long term.

3.2. Soil Chemical Properties

Incorporating and degrading crop residues into the soil can modify soil chemical properties (Coppens *et al.,* 2006). Work done by Dabney *et al.* (2010) shows that cover crops are a cost-effective and practical approach to increasing soil organic matter and overall soil quality. A study by Dube *et al.* (2014) found that soil organic matter contains almost all the nitrogen necessary for optimal crop growth and a significant amount of phosphorus and sulphur. Furthermore, Newman *et al.* (2007) demonstrated that soil organic matter is crucial in enhancing soil's cation exchange capacity (CEC), enabling it to retain and store essential macronutrients effectively. Additionally, cover crops may change soil pH by balancing organic acids and alkaline compounds (Harasim *et al.,* 2016). Preserving a suitable pH balance in the soil is critical for effectively accessing nutrients and microbial growth. As most cover crops decompose, they generally ameliorate soil acidity and discharge nutrients back into the soil, restoring the nutrient pool and enhancing nutrient accessibility to subsequent crops (Harasim *et al.,* 2016).

Worth noting is that certain cover crops, such as rye or oats, emit organic acids throughout their decomposition, which may temporarily decrease soil pH (Garrigues *et al.,* 2012). This acidification process may be advantageous for crops that favour slightly acidic environments, such as radishes (*Raphanus sativus*), sweet potatoes (*Ipomoea batatas*), and tea (*Camellia sinensis*) (Mukumbareza *et al.,* 2016). Conversely, due to their nitrogen fixation process, leguminous cover crops release alkaline compounds that can raise soil pH levels (Yu *et al.,* 2014). By regulating soil pH, cover crops create an environment conducive to nutrient uptake and microbial activity, ultimately enhancing soil fertility (Latati *et al.*, 2016). Farmers can optimise the accessibility of nutrients, enhance soil fertility, and decrease the need for artificial fertilisers by integrating cover cropping practices into their agricultural systems. Thus, covering crops benefits the general resilience and sustainability of farming systems.

4. LEGUMINOUS COVER CROPS AND SUCCESSIVE CROP BIOMASS PRODUCTION

Through nitrogen fixation, leguminous cover crops can influence vegetative growth and crop productivity of succeeding crops (Kocira *et al.,* 2020). Research carried out in Brazil found that using sunn hemp *(Crotalaria juncea*) as a cover crop increased the biomass generated by maize (*Zea mays)* by 66% compared to a fallowed treatment (Barros *et al.,* 2020). Similarly, Maris *et al.* (2021) found a 58% biomass increase in maize due to soybean (*Glycine max)* cover

cropping. A study by Daniel *et al.* (2021) compared leguminous cover crops with non-leguminous cover crops and found that planting leguminous cover crops that included cowpea (*Vigna unguiculata*) and hyacinth bean (*Lablab purpureus*) (similar to the bean) elevated maize biomass production by 60%. Comparably, research undertaken in the United States by Muhammad *et al.* (2022) discovered that utilising hairy vetch (*Vicia villosa*) and crimson clover (*Trifolium incarnatum*) substantially boosted the biomass production of maize and soybean crops.

Furthermore, Li *et al.* (2021) ran a meta-analysis of 88 studies on legume cover crops and discovered that they raised the biomass production of subsequent crops by an overall of 24.6%. The meta-analysis also found that the effect of leguminous cover crops on biomass production differed according to several variables, including the type of legume used, the length of time of the cover crop, and the management practices used. Another important factor is the higher soil nitrogen content (due to symbiotic nitrogen fixation), which encourages faster mineralisation of incorporated leguminous plant residues, facilitated by the lower C: N ratio of legumes' biomass (Toom *et al*., 2019). This is advantageous to the succeeding crop as a large C: N ratio (80:1 to 100:1, typically from stalks of cereal plants) can result in reduced N mobilisation and lower N availability.

The findings of the most recent research on the effects of using different leguminous cover crop species on the biomass production of various crops grown in different environments are summarised in Table 1. However, the species should be selected and managed efficiently to obtain the maximum benefits from leguminous cover crops. Some factors to consider when choosing leguminous cover crop species are their ability to adjust to local climates and soil conditions and the intended purpose of soil management. The management purposes may include the species' capacity to grow quickly enough to protect the soil and provide enough biomass (Khatri-Chhetri *et al.,* 2017). Additionally, most cover crops that thrive in tropical areas may be unable to endure harsh winters. Some commonly used cool season cover crops include winter hairy vetch, medics and red clover; however, sunn hemp, cowpea and soybean are widely used for the warm season (Ruis *et al.* 2019).

TABLE 1: Recent Studies on Legume Cover Crops and Their Effect On Subsequent Crop Biomass Production

Reference	**Legume Cover Crop**	**Subsequent Crop**	**Soil type**	**Results** (compared to control plot) Yield increase (%)
Abd-El-Mageed *et al.* (2022)	Cowpea and Peanut	Maize	Sandy soil	38 and 42
Akintoye *et al.* (2023)	Velvet Bean	Cassava	Loamy sand soil	87
Zhang *et al.* (2021)	Faba Bean and Hairy Vetch	Wheat	Degraded sandy loam soil.	40 and 34
Gaihre *et al.* (2020)	Cowpea & Sunn Hemp	Maize	Sandy soil	12 and 8
Vann *et al.* (2019)	Hairy Vetch & Pea	Soybean	Sandy loam soil	17 and 10
Tyagi *et al.,* 2018	Chickpea & Berseem Clover	Wheat	Sandy loam soil	27 and 18
Adnan *et al.* (2022)	Cowpea and Mung Bean	Maize	Sandy soil	13 and 8
Nadeem *et al.* (2021)	Hairy Vetch and Faba Bean	Maize	Loamy sand soil	14 and 11

5. ROLE OF LEGUMINOUS COVER CROPS IN COMPANION GRASS NUTRITIVE VALUE

Using legumes as a cover crop can enhance forage yield and quality and decrease dependence on external sources of nitrogen (Scholberg *et al*., 2010; Stagnari *et al*., 2017). Fernandez *et al.* (2021) conducted a study that looked at the consequences of four distinctive leguminous cover crops (clover, vetch, cowpea, and peanut [*Arachis hypogaea*]) on the yield and nutritional value of Bermuda grass (*Cynodon dactylon*) hay. It was discovered that all four legume cover crops enhanced the crude protein content of the hay, with cowpea being the most effective. Furthermore, it was found that the leguminous cover crops increased the digestibility and energy content of the hay. Additionally, a study by Fernandez *et al.* (2019) found that using legumes improved the crude protein content of lucerne (Medicago sativa)/grass mixtures and the accessibility of nitrogen and phosphorus in the soil. Crude protein content is directly influenced by the plant absorption of nitrogen (da Silva Santos *et al.,* 2021). A study by Balehegn *et al.* (2020) discovered that the integration of legumes in mixed grass pastures elevated the consumption of the forage and improved its digestibility by cattle. An additional potential benefit of leguminous cover crops is the expansion of the grazing season, which may lead to an increased supply of livestock forage. Phillips *et al.* (2021) also found that establishing leguminous cover crops after harvesting maize silage offered more forage for grazing cattle while improving the overall nutritional value of the forage. In another study, Bruce-Smith (2020) investigated the consequences of integrating lucerne as an additional crop to grass in grazing systems. It was discovered that lucerne boosted the protein content of the forage and the rate of forage accumulation, which led to a raised carrying capacity and stocking rate for grazing animals. A similar trend of increased nutritive value (crude protein and digestible energy content) was also observed with other legume cover crop species, such as red clover, when established for a more extended period (Khatiwada *et al.,* 2020), vetch and clover (Sharma *et al*., 2018) and lucerne, which improved the weight gain of beef cattle grazing on the pasture (McDonald *et al.*, 2021). These results were similar to those of Corleto *et al.* (2019), who discovered that legume integration elevated the grass's forage yield and protein content.

Ball *et al.* (2020) found that incorporating legume cover crops into a mixed sward of grasses reduced nitrogen leaching and increased soil organic matter content compared with pure grass swards, which was beneficial to soil and plant nutrient management. The literature demonstrates that integrating leguminous cover crops into companion grass systems may

enhance forage nutritional value and efficiency, benefiting farmers and livestock producers by decreasing the requirement for purchased feed and improving animal performance. Additionally, by decreasing the need for synthetic nitrogen fertilisers and strengthening soil health, using legumes as cover crops may benefit the environment.

6. LEGUME SPECIES USED AS COVER CROPS AND THEIR SUCCESS IN SOUTH AFRICA

Leguminous cover cropping has been used successfully in various farming methods throughout South Africa, including conservation agriculture, smallholder farming, and commercial agriculture (Swanepoel *et al.,* 2018). The hyacinth bean (the dolichos bean) is a popular legume cover crop in South Africa (Muzangwa *et al.,* 2017). Mupangwa *et al.* (2017) assessed four legume species as cover crops in maize production; apart from the hyacinth bean, the other species were cowpea, soybean, and velvet bean (*Mucuna pruriens*). The study confirmed that leguminous cover crops increased soil fertility, decreased weed populations, and improved maize yields by up to 24%.

Otto *et al.* (2020) investigated the efficacy of hyacinth bean, cowpea, and velvet bean in sugarcane production *(Saccharum officinarum).* Their research found that the legumes enhanced soil health, decreased weed populations, and elevated sugarcane yield by up to 22%. These findings aligned with an earlier study by Thierfelder et al. (2013), who found enhanced soil fertility, minimised weed density, and elevated maize yield (up to 31%). In a maize-based cropping system in KwaZulu-Natal, Sebetha (2015) examined the efficacy of four legume cover crops—hyacinth bean, cowpea, soybean, and pigeon pea (*Cajanus cajan*). Sebetha (2015) found that all four legume cover crops raised soil fertility and maize yields. Hyacinth bean and cowpea were the most successful at weed suppression (Sebetha, 2015).

In South Africa's Eastern Cape province, a study by Phophi *et al.* (2017) compared the growth and yield of maize crops planted after various legume cover crops, such as hyacinth bean, cowpea, and velvet bean. The research found that maize established after legume cover crops produced substantially greater yields than maize planted without a cover crop. In addition, soil fertility was enhanced, as demonstrated by increased soil organic matter and plant-available nitrogen levels. Table 2 shows some legume species grown as cover crops in South Africa, as well as how well they perform in different soil types. This data provides an idea of the ideal soil conditions for each legume species. These findings indicate that legume cover crops can

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be useful for enhancing soil health and crop yields in South Africa. However, the effectiveness of leguminous cover crops differs based on soil type, climate, and farming practices, so site-specific research is necessary to tailor cover crop selection and management to local conditions.

TABLE 2: Common Species of Legume Cover Crops and their Success in South Africa's Various Soil Requirements

Legume species	**Success in South Africa**	**Soil type requirements**	**Reference**
Cowpea	High	Well-drained, sandy loam	Caradus *et al.,* 2023
Hyacinth bean	Moderate	Well-drained, loamy soil	Ema *et al*., 2022
Peanut	High	Well-drained, sandy loam	Bertino *et al.,* 2023
Lucerne	High	Well-drained, loamy soil	Nguyen *et al*., 2022
Clover	High	Well-drained, sandy loam	Caradus *et al.,* 2023
Lupins	High	Well-drained, sandy loam	Mupambwa & Wakindiki, 2012
Hairy vetch	High	Well-drained, sandy loam	Fourie *et al.,* 2021
Sunn hemp	High	Well-drained, sandy-loam	Gura *et al.,* 2023
Medics	Moderate	Well-drained, sandy loam	MacLaren *et al.,* 2021

7. COVER CROP INTEGRATION WITH LIVESTOCK GRAZING

Soil erosion, nutrient depletion, and greenhouse gas emissions are all major issues confronting agricultural systems worldwide. In recent years, there has been an increasing interest in sustainable farming practices to address these issues, including incorporating cover crops with livestock grazing (Scholberg *et al.,* 2010; Stagnari *et al.,* 2017). Scholberg *et al.* (2010) reported that cover crops and livestock grazing are two agricultural practices that have received much focus because of their potential for environmental and economic benefits. In grazing fields, cover crops are planted to boost soil health, prevent erosion, and enhance nutrient cycling. Integrating cover crops with livestock grazing is a promising approach for long-term agriculture (Roesch-McNally *et al.,* 2018). It offers various environmental and agronomic benefits, including soil erosion management, nutrient cycling, weed suppression, and enhanced soil health (Stagnari *et al.,* 2017). Properly managed grazing on cover crops may offer excellent forage, which might improve livestock performance while decreasing the need for supplementary feed (Hedley, 2015). Overgrazing, on the other hand, can harm both forage production and soil health. Williford *et al.* (2019) found that as animals move and graze, they can compact topsoil layers and improve soil structure, infiltration, and root penetration. Livestock add organic matter through manure deposits and enhance soil health by boosting organic carbon content and promoting microbial activity (Ewing, 2020). Gaskin et al. (2021) found that grazing animals successfully restricted weed growth by trampling, uprooting, and eating weed species. Likewise, combining livestock grazing and cover crops reduced the need for herbicides while providing an alternative, long-term weed management strategy (Gaskin *et al.,* 2021). Some cover crops have allelopathic properties or physical characteristics that inhibit weed growth. The allelopathic properties of such cover crops may cause growth challenges for the follow-up cover crop if volunteer plants are not carefully managed. Therefore, encouraging the usage of cover crops in conjunction with livestock grazing is critical for expanding sustainable agricultural systems.

8. LEGUME COVER CROPS' ECONOMIC BENEFITS UNDER INTEGRATED CROP-LIVESTOCK SYSTEMS

Integrated crop-livestock systems (ICLS) are growing in popularity owing to their capability to improve agricultural sustainability, productivity, and profitability (Cortner *et al.,* 2019). Knowledge of the economic benefits of legume cover crops is critical for farmers seeking to implement sustainable and profitable farming practices. Roesch-McNally *et al.* (2018)

investigated the economic advantages of legume cover crops in a maize-soybean rotation incorporated with cattle foraging. They found that incorporating legume cover crops decreased nitrogen fertiliser costs and enhanced livestock feeding efficiency, resulting in a projected net return increase of R3378.97/ha. Similar research conducted by Macholdt *et al.* (2021) pointed out that incorporating legume cover crops minimised the need for synthetic nitrogen fertilisers, which resulted in cost savings of R1126.33/ha and a 10% increase in wheat yields. Furthermore, legume cover crops supply high-quality forage for cattle, lowering feed costs and increasing livestock productivity. Blanco-Canqui *et al.* (2022) performed a meta-analysis to assess the economic benefits of incorporating legume cover crops into maize and soybean systems. Their findings implied that including legume cover crops resulted in a 27% decrease in nitrogen fertiliser costs and a 5% increase in crop yields, resulting in an average net economic benefit of R2342/ha. A similar study by Qin *et al.* (2021) revealed that incorporating legume cover crops reduced nitrogen fertiliser costs by 52% while increasing soybean yields by 7%. Karthik *et al.* (2021) reported the economic gains of incorporating legume cover crops into a mixed farming system that included cereal crops and sheep grazing. Their results suggested that including legume cover crops reduced synthetic nitrogen fertiliser costs by 30% and increased lamb growth rates by 15%.

Moreover, Vázquez-Espinosa et al. (2020) concluded that incorporating legume cover crops (such as cowpea and soybean) improved soil fertility, decreased the need for chemical fertilisers, and increased maize yields, resulting in higher economic returns for farmers. Furthermore, incorporating pigeon peas and hyacinth beans reduced pests and weeds, leading to higher maize yields (Daryanto *et al.,* 2018). Research shows that legume cover crops improve cost-effectiveness by lowering fertiliser costs, suppressing weed growth, and reducing the need for herbicides. Also, legume cover crops provide high-quality forage for livestock, increasing animal productivity and lowering external feed costs.

9. LIMITATIONS

Several abiotic and biotic factors can reduce legumes and nitrogen-fixing bacteria's ability to fix nitrogen (Kasper *et al*., 2019). Therefore, it is necessary to inoculate legume seeds with *rhizobia* strains before planting them. Adequate soil moisture is required for legume cover crops to fix nitrogen effectively. Hence, leguminous seeds should be planted when the soil is moist e.g., during the rainy season or under irrigation (Kasper et al., 2019). A deficiency of

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nutrients such as molybdenum and phosphorus can seriously affect nitrogen fixation and nodulation, while high nitrogen levels in the soil inhibit nitrogen fixation (Kasper *et al*., 2019). Some cover crops may serve as hosts for insects and pathogens; therefore, it is important to carefully select cover crop species, considering the pests that affect main crops (Lu *et al*., 2015). Other limitations include the cost of purchasing and establishing leguminous cover crops, especially for smallholder farmers, due to possible cash flow constraints. Increased labour costs for managing cover crops and purchasing the appropriate machinery to plant, harvest and terminate cover crops can increase production costs. The required cover crop farming machinery includes mowers, no-tillage seeders and transplanters (Lu *et al*., 2015). Because harvesting the main crop is the priority, cover crops are typically planted later rather than earlier (Kaspar, 2008). Lastly, covering crops does not yield results immediately, which may increase production costs as the farmer needs to spend money on operational costs (Hoorman, 2009; Silwana *et al.,* 2023).

10. CONCLUSION AND RECOMMENDATIONS

Leguminous cover crops can significantly increase grasses' biomass and nutritional value in South African soils. They have special qualities in establishing mutually beneficial partnerships with *rhizobia*, which are nitrogen-fixing bacteria. There are several advantages to incorporating leguminous cover crops into grassland systems. These include the ability of legumes to contribute to the general biomass of the system by supplying organic matter to the soil. Furthermore, the increase in organic matter benefits grass growth by improving soil structure, moisture retention, and nutrient cycling. Leguminous cover crops also have greater nutritional value than grasses since they comprise higher protein levels and other vital nutrients. Including legumes as cover crops can be particularly advantageous in South African soils, which mostly have low fertility and restricted availability of external inputs. It is essential to remember that the efficacy of legume cover crops for improving biomass and nutritional value may vary based on various factors, including the legume species used, soil conditions, climate, management practices, and crop rotation approaches. To maximise the advantageous effects of cover crops in South African soils, it is suggested that suitable legume species be chosen and cover crops be managed in accordance with the specific circumstances.

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Creating Livelihoods Through Land Redistribution: Evidence from the One Household - One Hectare Programme in Kokstad

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ABSTRACT

The South African land redistribution programme has been criticised for solely focusing on redistributing land for commercial farming while ignoring land demand for small-scale farming and settlement. This study reports on implementing the One Household-One Hectare (1HH-1H) programme in two Kokstad beneficiary villages. The study's first objective was to understand how the programme implementation works on the ground. The other objective was to assess the capacity of the programme to create livelihoods. Our analysis was based on household survey data from 20 beneficiary household heads and two agricultural advisors. The data was analysed using descriptive statistics. Findings show that the programme implementation was need-based and was a joint effort by various government departments. The implementation led to a village setup, where each beneficiary household has a residential area for buildings, kraals and a garden in their one-hectare plot. The remainder of the land was shared as grazing common and forest, while the other arable land was used for cooperative farming and individual arable field lands. In general, beneficiaries were content with the programme's implementation and reported a significant increase in their livestock herd and crop outputs. Additionally, beneficiaries now enjoy access to clean drinking water, irrigation water, and primary healthcare, among other benefits.

Keywords: Land Reform, Rural Development, Public Services, Aspirations.

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1. INTRODUCTION

After the transition to democracy, the South African government committed to resolving the land question using three sub-programmes (see documentation in the Department of Land Affairs [DLA], 1997). The first programme was geared towards strengthening the tenure rights of farm workers and communal residents, the second one sought to restore land that was forcefully taken from original occupants during the colonial period, and the last sub-programme was intended to correct the skewed racial land ownership by redistributing it fairly and justly (the focus of this study).

While land redistribution remains one of the key tools for alleviating poverty in rural communities (Bonti-Ankomah, 2001), itis still one of the greatest challenges facing the post-apartheid government. Specifically, the main problems include the slow pace at which land is being redistributed and the creation of livelihoods on the redistributed land. Key to the root cause of these problems is the inefficient implementation of whatever is written on paper as a policy.

Both scholarly literature and government reports on land redistribution programmes acknowledge that land redistribution must address the land needs of all beneficiaries (Aliber, 2019; DRDLR, 2013; Rusenga, 2020). The beneficiary list includes households or individuals who require land for commercial farming and those who require land for small-scale farming. The latter group represents the greatest demand, which remains unmet despite the strong will to subdivide the large commercial farms intended for land redistribution (Zantsi et al. 2021).

One of the land redistribution policies that has sought to address the needs of households who require land for residential and small-scale farming purposes is the 1Household-1Hectare (1HH-1H) programme, which was first introduced in 2015. In the 1HH-1H programme, farms acquired through the Pro-active Land Acquisition Strategy (PLAS) would be allocated to a group of households such that each household receives an equivalent of a hectare and obtains a certificate of use (Aliber et al., 2018). However, since the introduction of the 1HH-1H programme, no further information has been made available – neither via scientific publications nor publicly. Therefore, this article reports on a case study of households who benefited from this policy in two Kokstad villages.

The objectives of this paper are (1) to describe the implementation of the 1HH-1H programme and (2) to illustrate how livelihoods can be created through the small-scale farm model on redistributed land. By livelihood, the paper refers to the means of securing the necessities of life. This includes a place to build a house, keep livestock, and have a small garden. It is understood that through agricultural activities, one can generate income, produce one's food, and secure off-farm work closer to where one lives.

The remainder of the paper is structured as follows. The next section contextualises the study by reviewing the literature on any progress made regarding land redistribution to date and debates on its status. Data and methods are described in Section 3, Section 4 discusses the research findings, and Section 5 presents the findings and conclusion.

2. REVIEW OF LITERATURE ON LAND REDISTRIBUTION

This brief literature review aims to situate this study's central argument within the broader literature on land reform, rural development and poverty alleviation. The first part reviews land redistribution modalities and their progress thus far. These aspects are followed by a discussion of the reasons behind the progress, which boils down to land subdivision and the advocacy to meet the land demands of people requiring smaller land size. These aspects and land expropriation represent some major land reform debates.

South African land reform has three components: land tenure reform, land restitution, and land redistribution, which are the focus of this study (Department of Land Affairs 1997). Since its inception after 1994, the land redistribution programme has been implemented through various modalities. The latter include the Settlement Land Acquisition Grant (SLAG) of 1997–2000, the Land Reform for Agricultural Development (LRAD) of 2000–2010, the Proactive Land Acquisition Strategy (PLAS) of 2006–present, and the State Land Lease and Disposal Policy (SLLDP) of 2013. Among the sub-programs of PLAS, including equity share schemes, is the 1HH-1H programme. This brief literature overview looks at current land reform debates, the progress achieved regarding land redistribution, and the impact on beneficiary livelihoods.

2.1. Redistributed Land So Far and its Impact on Beneficiaries

The implementation and progression from one modality to the other have been largely informed by the efficacy of each modality to deliver the expected outcomes, among other things. The overall outcome of these modalities in redistributing land is estimated at around 10% of South

Africa's commercial farmland (LRAAP, 2019). However, when private sales by black people are considered, it is estimated that the target of 30% in 2014 has been achieved (Vink & Kirsten, 2019). Nevertheless, stakeholders still feel that the land redistribution is too slow and that it has done little to improve the livelihoods of the beneficiaries, as most of the redistributed land is not being used productively (Aliber & Cousins, 2013; Kirsten et al., 2016; Mtero et al., 2019; LRAAP, 2019).

Bradstock's (2006) study on restitution and redistribution in the Nothern Cape found that beneficiary land has not contributed materially to the livelihoods of beneficiaries. This failure has been mainly because the redistributed and restituted land was geographically remote from the beneficiaries' residences and because of the lack of service or technical support to assist beneficiaries with start-up agricultural activities. Bradstock concludes that land reform is ineffective for poverty reduction in rural South Africa.

As for the other case in a different province, Aliber and Cousins (2013) argue that land reform has not had a noticeable impact on beneficiary livelihoods. In their analysis of land tenure security, land restitution, and land redistribution, case studies in Limpopo found minimal impact on livelihoods and blamed the large-scale commercial farm model for its capital-intensive nature and non-alignment with the realities and aspirations of beneficiaries. Kirsten et al. (2016) in the Northwest province also found little evidence of any improvement in beneficiary livelihood after they received farms under SLAG. Kirsten et al. (2016) blamed the lack of post-settlement support, large groups and group dynamics as the causes of project failure. Yet, Beinart et al. (2020) documented some evidence that some small-scale land reform beneficiaries have been able to expand their assets and assert their rights over land in Stutterhem in the Eastern Cape.

2.2. Reasons for Poor Progress

There are certainly several valid reasons behind the slow progress. Myriad explanations and rationalisations have been made for said reasons in the scientific literature. Zantsi (2021) identified the following reasons in development economics literature: insufficient post-transfer support, poor beneficiary selection, large farm size coupled with lacking or incompetent farming skills, and the reluctance of the state to give freehold titles to beneficiaries, along with the limited programme budget.

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2.3. Current Land Reform Debates

Two important and recent debates that result from the poor progress and implementation of the programme, as mentioned in the preceding paragraphs, are land expropriation and subdivision of land reform farms. With regards to the second point, there is ample evidence of high demand for small land parcels from potential beneficiaries, ranging from less than a hectare up to 100ha, which is way below the average commercial farm of 2000ha (Aliber et al., 2006; Liebenberg, 2013; Zantsi & Greyling, 2021; Marcus et al., 1996). As such, there has been strong advocacy for the government to scrap the Land Subdivision Act of 1970 and allow for the subdivision of land (Aliber, 2019a; Aliber & Cousins, 2013; Binswanger-Mkhize, 2014; Rusenga, 2019). The land reform and agriculture advisory panel appointed by the president in 2019 has supported this advocacy (LRAAP, 2019). Evidence exists that small farms are relatively easy to manage, and beneficiaries can finance farm operations from their pockets (Rusenga 2020; Zantsi et al. 2021). The 1HH-1H program is one of the forms of small-scale farming that emerged from the land subdivision debate (we will come back to it in the following sub-section).

The other controversial debate is that of land expropriation without compensation. This represents the most radical action fueled by frustrations over the slow progress and was first proposed by the Economic Freedom Fighters (EFF) party and later adopted by the ruling party, the African National Congress (ANC) (Conradie, 2019; LRAAP, 2019; Xaba, 2020). Only the expropriation of less productive and unused land (Ramaphosa 2020) has been partially approved. However, such land types are challenging to find because of the vagueness of their definition. As such, there still is no evidence of implementation.

2.3.1. The One Household One Hectare Programme

The 1HH-1H policy was launched in 2015 by the then minister of Rural Development and Land Reform (now Department of Agriculture, Land Reform and Rural Development), Gugile Nkwinti, in Gorah farm, Kenton on Sea, at the Ndlambe local municipality. Each household is entitled to one hectare of land, which is acquired through one of the land redistribution modalities (DRDLR, 2016). According to Mr Nkwinti, “Land acquired by the state will be surveyed by the Surveyor General, land use plans will be formulated, and a notarial title deed will be issued to each household”. He further stated that if there is a remainder of land after each household has been allocated one hectare, said land will be communally owned and designated for collective use, i.e., grazing land.

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Moreover, it is said that households will be supported to produce for consumption purposes and to organise themselves into a primary cooperative linked to the Agri-Parks initiative (DRDLR, 2016). The programme is said to be funded through the Recapitalisation and Development Budget, and the government has set aside R100 million for the first year of the programme (Shopane, 2017). However, this policy has not received sufficient attention despite the support from gender equality movements. It has been criticised by the African Farmers Association of South Africa for limiting potential opportunities for its members (Kepe & Hall, 2016).

The 1HH-1H programme is more pro-poor, unlike the land reforms implemented in other countries such as Botswana, where the focus was on increasing agricultural productivity, conserving range resources, and improving social equity. However, evidence suggests that agricultural land reform policies such as the Tribal Land Grazing Policy and the National Policy on Agricultural Development harmed many poor households living in communal areas (Malope & Batisani, 2008). These authors reported that poor people were excluded due to high land development costs, ownership of only small herds or no cattle at all, and the lack of human capital.

3. METHODOLOGY

3.1. Description of the Study Area

The redistributed farms studied here, now villages, are situated at Aloekop under the Greater Kokstad Municipality in KwaZulu Natal. The Greater Kokstad Municipality is one of the five municipalities constituting the Harry Gwala District Municipality. The Greater Kokstad Municipality covers a land area of approximately 2 682 km². According to the latest available census conducted in 2011, Aloekop has a population of 809 people living in 209 households (StatsSA, 2011). The same census further shows that, on average, a household has 4.3 persons. Females constitute the majority of the population ,51% and the population comprises black Africans. The dominant language is isiXhosa (81%), followed by Sotho (13%) and Zulu (5%). More than half (56%) of the population is of working age, between 15 and 64. Most households (39,9%) earn between R19,601 - R38,200 a year.

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3.2. Data and Sampling

Two types of data were collected, namely qualitative and quantitative. The data was collected from three sets of participants: individual household heads, focus groups and two agricultural advisors. Data were collected from a sample of 20 beneficiary household heads, representing 20% of the total beneficiaries of the programme in the case study. Two extension advisors were interviewed. One of them was a general advisor and was present from the beginning of the project. The other was employed on a year contract as a farm manager for the cooperative farming part of the project.

The latter advisor, advising the beneficiary households on their farming aspects and coordinating the project development funds, acted as a form of participatory rural appraisal. According to Chambers (1994), participatory rural appraisal refers to 'a family of approaches and methods to enable rural people to share, enhance, and analyse their knowledge of life and conditions, to plan and to act.' Since the cooperative advisory farm manager was interacting with the beneficiaries daily and had been observing the project's progress, he was deemed a good source of information. His primary role was to assist beneficiaries in managing the cooperative farming aspect of the 1HH-1H programme as per the approved business plan, which is required for the post-settlement support intended for land reform benefactors.

3.3. Analytical Approach

The analysis of field survey data is guided and informed by the Sustainable livelihood framework (SLF) (Scones, 1998). The SLF provides a comprehensive and complex approach to understanding how poor and vulnerable people, amid policies (such as land reform), use their livelihood assets to form livelihood strategies to earn a living (Sharaunga & Mudhara, 2021). The study partly reports the findings using the five livelihood assets and by analysing the data descriptively. The analysis is also influenced by similar studies such as Puttergill et al.'s (2011) and Hart's (2012) investigations that also assessed the impact of a land reform programme. Therefore, as used in these studies, research methods included participatory rural appraisal, surveys and ethnographic fieldwork. The researcher's engagement with farmers is summarised in a narrative and descriptive manner.

4. RESEARCH FINDINGS

This section presents the research findings of the field survey and focus group discussion with the beneficiaries of the 1HH-1H programme. It first presents the respondents' background information before focusing on the land reform farm. It then describes the implementation process before using the SLF lens to assess the 1HH-1H programme's impact on beneficiary livelihood.

4.1. Background of the 1HH-1H Programme Beneficiaries

Before 2002, the beneficiaries of the 1HH-1H programme in Kokstad had initially lived in Pakkies, a rural village in Kokstad that belonged to the Pakkies family. Because this is a family-owned land and non-Pakkies families were considered outsiders, their tenure to the land was not secured. Any disagreements about village affairs were used against the outsiders, who were constantly reminded by the Pakkies that they were just visitors in their land and had no say in the governance of the land. For example, they had no say in community meetings on the development of the village and the allocation of plots to young people. Since land was becoming scarce and controlled by the Pakkies, outsiders found it riskier to have larger herds of livestock and had limited access to arable land. Even the development of their homesteads appeared riskier as conversations of eviction were starting to emerge. This only ended when their story came to the attention of the local municipality, which informed the local agriculture department.

4.2. The Implementation of 1HH-1H Programme in Kokstad

The Department of Agriculture, Land Reform and Rural Development (DALRRD) officials informed the outsiders from the Pakkies village about the 1HH-1H land redistribution programme and explained how it worked. They had to complete an application form accompanied by necessary documents and apply for a farm to the DALRRD.

Around 2002 and 2006, after the application for a farm was successful, the respondents, a group of 50 households, obtained a 12 818 hectare farm named Thuthuka Ngele at Aloekop. Another 50 households were awarded a 15 569 hectare farm at Ekuthuleni in the same area. The farms were bought for R1 169 136 and R1 360 000, respectively. These farms are next to each other and were initially used for commercial livestock farming. Since the farms and villages were similar in many respects, the researchers did not perform a comparative analysis. The farms

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were approximately five kilometres from Pakkies, where respondents originally came from before relocating and occupying the farms. The farms were bought under the Land Redistribution for Agricultural Development modality, a land redistribution pillar of the land reform policy.

However, they did not receive funding for relocation because it does not form part of the land reform program, at least for land redistribution, despite the dire need to start over building homesteads. During the focus group discussion, relocation and starting over appeared difficult for most of the beneficiaries, especially the poorest households. As such, only a few households relocated immediately after receiving the land; other households took a year or a couple of years to relocate (Focus group discussion, 2022). The government has poorly conceptualised the beneficiary relocation aspect of land reform (Bradstock, 2006; Zantsi et al., 2022).

It appeared that it is the beneficiaries themselves who decided to use the land in this form of village setup, where each household has a plot comprising of a section for buildings, kraals for panning livestock and a piece of arable land adjacent to the homestead, commonly known as a ‘garden’. Hence, this was known as the bottom-up approach. In addition to these sections of the land, a household can have an arable field for planting field crops. The village then shares grazing land, which is divided into camps. Other arable fields are -fenced to be used by the villages as agricultural cooperatives. This is where the post-settlement support funding is used, for example, to purchase farm machinery, tilling implements, production inputs (seeds, fertilisers and pesticides) and money to employ a farm manager or qualified advisor to guide the cooperative.

Additionally, the advisor helps the beneficiaries compile a list of needed equipment and implements in the production process. The cooperative farming land is where the previous owner's farm buildings were situated. However, since the buildings and farm implements were in bad condition, the beneficiaries of 1HH-1H needed to purchase new implements and renovate the farm buildings.

According to the extension advisor, the implementation of the 1HH-1H was a joint project between government departments. In addition to DALRRD, the Departments of Water and Sanitation, Public Works, and Education also played a role. The researcher observed that

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several households had running water taps and pit toilets in the village. Additionally, most villages had a school, a clinic and a community hall.

4.3. Respondents' Demographic Information

Half (50%) of the respondents in this study had secondary education, while 30% had tertiary education. The remainder had informal training in farming as some had been farm workers, and others still worked on neighbouring farms. All the respondents in this study, including those with education qualifications, had 16 and 20 years of small-scale farming experience. In terms of abilities and good health, the respondents in the study were, on average, 51 years old, a somewhat physically active age.

Each household has a hectare of land. Some have fields, and all households share grazing land. Unlike in Pakkies, where they come from, in their new village, the respondents in the study have secure tenure in their land and access to a larger portion of land. Now, they can cultivate larger plots and keep larger herds of livestock. For example, the average herd size for cattle is 29, for sheep 51 and goats 28. The average herd growth since they relocated to the 1HH-1H farm was almost 300%, partly because of access to a larger grazing area. The livestock is used for family needs, such as rituals and sales of mainly non-breeding stock, the castrates. Several respondents with arable land mostly plant maize and vegetables for their own household consumption, and very few sell their produce, mostly vegetables, because of their perishability. Apart from municipal clean drinking water, a river passes through the farm for irrigation, and dams are used for drinking water for livestock. Moreover, there are patches of black wattle forests for harvesting firewood. Thatch grass is also harvested from the grazing lands.

The respondents in the study combine income from multiple sources, a common practice in many South African rural communities (Mamabolo et al., 2022). All the respondents in the study acknowledged gaining income from agricultural activities such as livestock and crop sales, in addition to income from one or more of the social grants, most of which come from child support grants. Other contributions to income sources (80%) were salaried employment, while 20% came from self-employment, such as being a street vendor. Half of the respondents (50%) stated that their monthly household income is between R10 001-R20 000, while 20% said that their income was between R5 000-R10 000 and R20 001-R30 000. Only a few respondents (10%) had low incomes, falling between R2 000-R5 000. Most of the respondents in the study could afford a household food basket, which in August 2022 was R4,775.59.

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All our respondents had fenced gardens where they could cultivate food for household consumption. About 90% kept some form of livestock herd. Additionally, respondents demonstrated some form of household labour pull. The average household size in these villages was six persons. Of this average, more than half constitute the working age between 16 and 40 years.

The beneficiaries of the 1HH-1H in Kokstad relocated with their immediate families. Forty percent (40%) of them relocated with relatives like brothers and uncles, who also have their households (Survey data, 2022). Others relocated with friends. Therefore, the social kinships were not broken like in apartheid-forced removals such as the Betterment Planning that broke such kinships and ties (de Wet, 1995). For the beneficiaries of the 1HH-1H in Kokstad, this provides a backup system in difficult times because they can go and ask for help, borrow money or share groceries with relatives or neighbours.

Apart from individual farming on the arable land adjacent to their homesteads, beneficiaries farm together as a cooperative. This includes field crops, vegetable cultivation, and poultry (broiler) farming. However, group dynamics and dependency syndrome appear problematic in these cooperatives (Aliber, 2019b) in the Eastern Cape. For the beneficiaries of the 1HH-1H in Kokstad, these cooperatives were not fully functional.

4.4. Livelihood Outcomes

It can be argued that assessing developmental programs, particularly land reform projects, should be beneficiary-centric (Hart, 2012). Table 1 summarises beneficiary views regarding implementing the 1HH-1H, focusing on land need satisfaction and impact on their livelihoods. The beneficiaries' views are predominantly positive and reflect a general satisfaction.

The major findings from the respondents' responses include gaining secure access to a larger piece of land, where they could keep larger livestock herds and cultivate more extensive arable land, enabling them to gain more from farming as a livelihood strategy compared to when they had no land. In gauging their opinion, statements 3.4, 3.5 and 3.7 show that more than 70%, 80% and 99% of respondents stated that gaining access to more land improved their farming output (see Table 1).

This finding corroborates one of the common assumptions and objectives of land reform policy: land redistribution will lead to increased agricultural production because of increased access to land (NDP, 2012). However, it contradicts empirical estimations from Ryan (2017), who found that the receipt of land did not correlate significantly with per capita household expenditure and that land received through land redistribution programmes does not necessarily translate into increased agricultural activity.

As a confirmation of the intention of the 1HH-1H policy regarding the award of small pieces of land to households to pursue their diverse livelihood strategies (DRDLR, 2016), the respondents in this study rely solely on farming to earn a living. Still, farming contributes to the portfolio of their livelihood strategies. This is what has been observed elsewhere where land has been transferred, whereby most people in rural areas do not focus primarily on agricultural production but rather on finding employment, using social grants, and engaging in small-scale agriculture as the ideal livelihood (Hart, 2012; Puttergill et al., 2011).

TABLE 1: Beneficiary Views on the Implementation and Impact of the 1HH-1H Program on their Livelihoods

Statements	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
3.1 Are you satisfied with the relocation to this farm?	10%	90%			
3.2 Did the relocation meet your expectations?	5%	80%	10%		5%
3.3. Do you have enough land now in your new farm (Kokstad) than in kwaPakkies?	100%				
3.4 Would you say your crop harvests have increased now because you have bigger land?		95%	5%		
3.5 Would you say you have more number of animals now because you have access to bigger land?	10%	70%	20%		

3.6 Would you say farming contributes more to your household income than it did in kwaPakkies?	8%	92%			
3.7 Would you say by farming you can now provide more food to your household that you did in kwaPakkies?	30%	69%	1%		

Access to land where they have secure tenure contributes to respondent's well-being because now they no longer fear being evicted and can expand their homesteads. Respondents have homesteads and secure tenure where they can pursue other livelihood strategies besides farming, including working in retail stores in Kokstad. Others even work as teachers in the local schools. Beneficiaries also have access to basic services, clean water, sanitation, primary health care, and road infrastructure. This outcome of the 1HH-1H program in Kokstad is the envisaged outcome of some parts of the land redistribution policy, especially for redistributing land for small-scale farming and settlement purposes (Aliber, 2019a; LRAAP, 2019).

However, the cooperative aspect of the project, where beneficiaries farm together, mainly crops and poultry, seems unsustainable. In the view of the advisory farm manager, the project has the potential to meet and maintain long-term viable business requirements. For him, the successful procurement of the mechanisation package, the implementation of the infrastructure, and the purchase of production inputs are some of the project's strengths. One can also add the link between the farmers and the relevant market and create strong relationships with the relevant stakeholders.

However, the advisory farm manager pointed to conflict and the lack of vision and passion amongst most beneficiaries as the immediate challenge that the project encountered. Some of these problems lead to free rider problems. He also mentioned some opportunistic behaviour among beneficiaries whereby some of the beneficiaries wanted to be service providers for the coop, which amounts to a conflict of interest. He further stated that the beneficiaries would not want to follow the business plan as a guiding tool and believed that the 12-month contract was insufficient for the advisory manager to transfer farming skills and empower the beneficiaries. For him, these negative factors bring into question the project's sustainability.

5. DISCUSSION AND CONCLUSION

Implementing land reform has proven to be a complex task with minimal certainty of the outcome. Also, it has proven to be a learning-by-doing kind of task. For example, the South African government has tended to change the modalities of redistributing land constantly. Recent debates on land reform have taken the public back to the original policy, the 1997 White Paper on Land Reform Policy, which states that land redistribution has to prioritise people who require small pieces of land for subsistence farming and settlement purposes and for those who need larger pieces of land for commercial farming. This objective was overshadowed by the strong belief that government officials, influenced mainly by the agribusiness lobby group, that commercial farming is the only real agriculture and land reform should solely prioritise beneficiaries who would like to practice the latter (Aliber & Cousins, 2013; Rusenga, 2020).

Recent studies have shown that given the small land reform budget, poor structure and insufficient post-settlement and the lack of staff capacity within the government, as well as the quest by the government to reduce chronic poverty, giving people small pieces of land could be one of the plausible and effective ways of addressing land needs and achieve poverty alleviation (Aliber, 2019a; LRAAP, 2019). Building on these debates, the Presidential Advisory Panel on Agriculture and Land Reform report has made a strong recommendation to the government to expedite the subdivision of agricultural land, while Zantsi et al. (2021) empirically drafted a beneficiary-centric suggestion on how to subdivide agricultural land to meet the demand and objectives of people who require small pieces of land.

To contribute to this debate, this study has looked at implementing one of the land redistribution policies that sought to cater to the demand of people requiring small pieces of land for residential and small-scale farming purposes. This was done based on a case study involving the Thuthuka Ngele and Ekuthuleni beneficiaries of the 1HH-1H policy in Kokstad. In exploring the main argument, the paper's first objective was understanding the programme's implementation process. This is motivated by the fact that implementation seems to be the single challenge of land reform (Aliber, 2019a). Therefore, understanding it could help to avoid pitfalls in future projects.

The findings of this study show that implementing this programme in Kokstad used a problem-solving or meeting-the-demand approach. In effect, the municipality identified a problem faced by a group of their people. It referred to one of their departments, DALRRD, which

spearheaded the process of addressing the problem of insecure land. This is solid evidence of how government departments can work together, which resonates with the intention of the 1997 White Paper on Land Reform Policy that land and agricultural services must be integrated to address the entire spectrum of social and physical needs of farm dwellers. The White Paper advocates for the 'convergence of health, education and social services [which] are important contributors to productivity in farming and rural sustainability" (DLA, 1997). This transpired in stark opposition to the reported incidents of poor coordination between various government departments (LRAAP, 2019).

Further, the land use plan largely s the needs and aspirations of the beneficiaries, which is rare to find in land reform implementation yet essential (Aliber et al., 2006; Zantsi et al., 2020). However, this project is not entirely beneficiary-centric because some beneficiaries in the study stated that they prefer to be supported as individuals and not as a cooperative because of group dynamics and free rider problems. In his view, the advisory farm manager also attested that conflict among beneficiaries was the major challenge in the cooperative aspect of the 1HH-1H project. Nevertheless, the problematic nature of group farming is not unique to this case study. Aliber (2019b) also reported it in his research based in the Eastern Cape. Cousins (2013) and Hall (2010) also raised concerns about the problematic process of collective farming by large groups on a single farm.

The other objective of this study was to assess the benefits of livelihood creation by the beneficiaries. This objective is also one of the main aims of land redistribution policies, particularly the 1HH-1H. This study contributes to the body of knowledge on the question by providing evidence of experiences and perspectives of stakeholders on how the receipt of land by beneficiaries has created or enhanced the creation of multiple livelihoods.

The researcher's analysis in this study was based on the Sustainable Livelihood Approach. In his analysis of household survey data, he found that the beneficiaries' relocation to the 1HH-1H farm allowed them to expand some of their livelihood assets, such as livestock, homesteads and crop cultivation. They also benefited from government agricultural support for cooperative farming, water, sanitation, and social infrastructure such as schools, community halls, roads, and primary healthcare. All support mechanisms contributed to their goal of creating a sustainable livelihood and their well-being. These non-agrarian contributions contrast with the sedentary thinking of many policies, which completely misses why people continue to base

themselves in rural areas while pursuing livelihoods and lifestyles they deem appropriate, relevant and desirable (Hebinck et al., 2023). However, their financial assets do not seem to permit a sustainable livelihood because, for many respondents, social grants constitute a larger portion of their livelihood strategies portfolio. Overall, in terms of the beneficiary views, implementing the 1HH-1HH program in Thuthuka Ngele and Ekuthuleni was somewhat satisfactory and successful because it met most of their dire needs.

Firstly, what could be learnt from this project is that beneficiary-centric and needs-based approaches are the key factors in the success of developmental projects. Furthermore, for development to succeed, cooperation between stakeholders is essential. Thus, developmental projects such as land reform should be flexible enough to incorporate beneficiary aspirations, as beneficiary aspirations hardly match policy objectives; hence, flexibility is needed. Moreover, policies are neither fixed nor static. They need to evolve and shift and, above all, be reworked by their actual beneficiaries (Long, 2001). Poor households should be supported with relocation costs, which could be implemented using household income as a qualifying criterion.

Lastly, cooperative farming in its current form is not efficient and sustainable in developing rural communities. Yes, it remains cost-effective and is a pragmatic way of assisting rural households given the government's limited resources (money, extension advisors, and so on). However, many loopholes promote opportunistic behaviour (e.g., free rider) and dependency syndrome in cooperative farming. Efforts should be made to minimise these loopholes through commitment, for example. This could eliminate free riders and beneficiaries with questionable intentions.

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An Investigation of Estate Planning Among Farming Businesses in the Western Cape Province, South Africa

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ABSTRACT

Estate planning is one of the important processes in managing a business, and farm owners often avoid it since it deals with emotional and difficult issues. Additionally, studies have highlighted that decision-making on future ownership of many businesses is still poorly understood. This study investigated the extent of the availability of estate plans amongst farmers in the Western Cape Province of South Africa. Interviews were conducted, and data was collected from 42 farmers using structured questionnaires following a mixed-method research design. Descriptive statistics such as mean, frequencies and percentages were employed. The study revealed that the majority (66,67%) of the farmers do not have any estate plan available. In comparison, 47,62% of the farmers were unfamiliar with the estate planning process. In addition, the study also revealed that the businesses own assets with a minimum value of R500 000 to a maximum value of over R2,5 million, showing differences in the commodities across the Western Cape Province. It is recommended that farmers be aware of their responsibilities regarding estate planning, and the Western Cape Department of Agriculture should conduct workshops around the legal side of the business. For funding purposes, the Western Cape Department of Agriculture needs to include conditions related to estate plans in the application forms to prevent the closure of businesses after the recipient's death.

Keywords: Estate Planning, Family Business, Agribusiness

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1. INTRODUCTION

In the Western Cape Province of South Africa, agricultural businesses are important due to their contribution towards job creation and Gross Domestic Product (GDP). According to the World Bank (2023) and Statista Research Department (2023), agriculture contributed 2,4% to the GDP of South Africa, while the sector employed over 860,000 people in 2022. According to recent data, it is highlighted that the sector outperformed all the other sectors between 2012 and 2021 by 44,9% (Western Cape Government, 2022). It was pointed out by Ntshangase et al. (2016) that for sustainability in the agricultural sector to be ensured, future generations have to continue playing a major role in farming. The sustainability of the sector, therefore, relies on existing estate planning. Tauer and Grossman (2002) and Sambrook (2005) define estate planning as the process of deciding how the assets should be distributed to the right people once death comes, whilst it also considers the techniques used to build the estate during life. An important point is made by Van der Merwe (2009), which states that estate planning is a crucial part of succession planning; hence, these two processes should not be divorced.

Recent statistics by Lowder et al. (2016) showed that there are more than 570 million farms globally, mostly family-operated and small. Concerning world farm statistics, approximately 12% of these farms operate on less than 2 hectares; furthermore, family farms operate on 75% of the agricultural land worldwide. Approximately 13 million people are employed by 267,959 businesses legally registered in South Africa (Small Business Institute, 2018). About 19 years ago, 65% of businesses in South Africa were in the agricultural sector, and 90% were family-owned businesses (Venter & Mass, 2005). In contrast, nine years ago, family-owned businesses grew by 5% to 95% (Gouws, 2015). The latter statistics show the importance of family businesses and why businesses must take estate planning very seriously, especially in the farming sector. Therefore, the failure of family-owned businesses could have a negative impact on these statistics. A study by Modise (2011) in the Free State Province indicated that each family's estate and succession plans are unique. This also demonstrated the importance of such planning in the long-term sustainability of businesses.

Previous studies, such as the one conducted by Markowski-Lindsay et al. (2017), show that there are several businesses with no plans regarding the future, while some have only wills

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and no form of planning for succession. It is further noted that business owners still poorly understand estate planning and decision-making around future ownership. According to Walsh (2011), about 70% of businesses will find it hard to transfer their operations to the second generation. Further, about 90% of the businesses will not make it to the third generation, even though most businesses would like to transfer their businesses to the subsequent generations.

Edobor et al. (2021) highlighted inadequate transition planning by business owners as the most important reason why most businesses struggle to transfer their businesses to the next generation. Small-scale and medium-scale businesses are the backbone of many economies; therefore, estate planning is vital because their failure will negatively affect the economy. Therefore, given the low rate of success in transferring assets in the future to the next generation, it is very important to understand considerations made by the owners at present concerning estate and succession planning. As stated by Edobor et al. (2021), the lack of these plans will affect the contribution that the agribusinesses make towards job creation, export earning and providing food to rural markets. In recent years, the issues of farm succession, retirement, and inheritance have gained significant importance. However, family businesses and farm owners generally find farm succession challenging, putting these discussions on hold for many years. It is highlighted that for farmers, especially males, the issue of thinking about letting go of being the owner can be an issue to their identity. The majority feel that their role in the family, business, and among their peers may be perceived as inferior (Wheeler *et al*., 2020). The purpose of the study, therefore, is to understand the accessibility/disposal of the estate plans and the rationale behind not having these plans for those farmers who might not have considered their necessity.

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The study was conducted in the Western Cape Province across the six district municipalities with a total of 69 152 prevalence of agricultural households (Statistics South Africa, 2018). The Western Cape is one of the Provinces in South Africa. It has an estimated population which makes up 11,9% of the country's total population, with a life expectancy of 71,7 and 66,3 years for females and males, respectively.

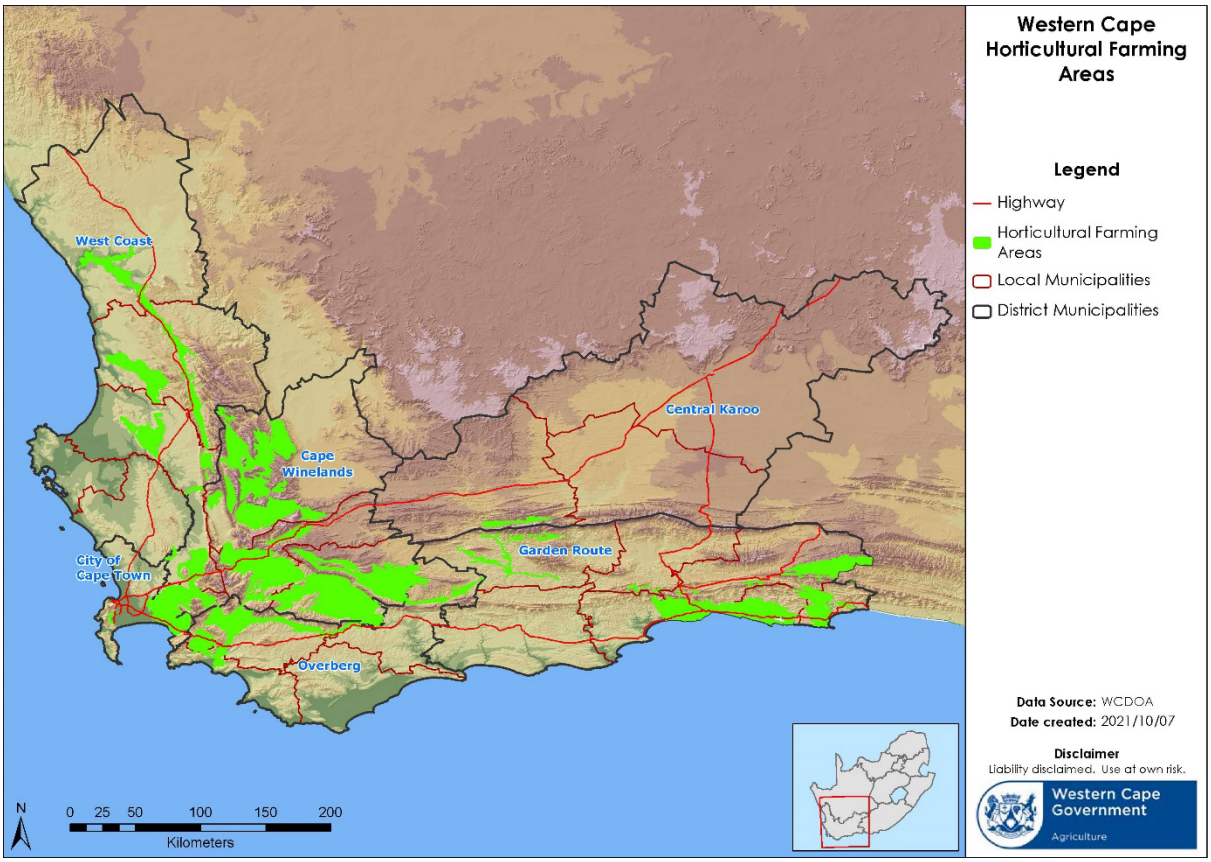

FIGURE 1: Map Depicting the District Municipalities of the Western Cape (Source: Morokong et al., 2022).

The Western Cape borders the Eastern Cape and the Northern Cape Provinces. It has 25 municipalities, five districts and a metropolitan municipality. It is situated in the Southwest part of South Africa (Morokong *et al*., 2023). The province of the Western Cape covers approximately an area of 129 462 km² (Municipalities of South Africa, 2023). The province of the Western Cape is different from the rest of the provinces in terms of climate because the coastal areas have a Mediterranean climate. In contrast, the inland areas experience a semi-desert climate (Morokong *et al*., 2023). According to the sector profile of the Western Cape agricultural production, there is a total of just over 787 000 hectares that are planted with crops, of which 85,69% of these hectares are based in three districts: the Western Coast, Cape Winelands and the Overberg (Morokong *et al*., 2023).

2.2. Sampling Procedure

A descriptive research design was adopted to conduct the research. In addition, a mixed research (qualitative and quantitative) method was followed. A mixed method was followed,

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using qualitative information to get insight into the quantitative results. A total of 42 agribusinesses that are part of the Financial Record Keeping Programme of the Western Cape Department of Agriculture were selected across six district municipalities of the Western Cape. The Financial Record Keeping Programme (FRKP) assist agribusinesses in the Western Cape with proper and accurate financial record-keeping systems in their agribusinesses for sound decision-making. According to the database of the FRKP, 42 agribusinesses are participating in the programme: West Coast (11 agribusinesses), Cape Metro (4 agribusinesses), Cape Winelands (10 agribusinesses), Garden Route (15 agribusinesses), Overberg and Central Karoo (2 agribusinesses). Questionnaires were used as a data collection instrument to collect primary data. Due to the size of the population, all the agribusinesses were interviewed. Therefore, a purposive sampling procedure was used because only agribusinesses that were part of the FRKP were selected.

2.3. Data Analysis

Data that was collected through structured questionnaires was analysed using Statistical Package for the Social Sciences (SPSS), moonstatistics and Microsoft Excel for better visualisation and analysis. Descriptive statistics such as frequency distribution, percentages and means were used to answer the research objectives. Lastly, bivariate correlation and chi-square tabulation were used to determine if there exists a relationship between the size of the agribusiness in terms of the value of assets and the decision to have estate plans in place.

3. RESULTS AND DISCUSSION

3.1. Demographic Characteristics of Agribusinesses

The study results shown in Table 1 on the distribution of gender, marital status, age of the agribusiness owner and educational level showed that just over 64% of the respondents were males. In comparison, the majority (69%) of the business owners were married. In addition, over 61% of the business owners interviewed were over 51. According to Lingani (2022), the agricultural sector is dominated by males, except for subsistence farming, due to the physical nature of farming. Olsson and Martiny (2018) suggest that this could be a result of the gender role beliefs that influence career paths in fields such as agriculture. Other studies, however, have shown an increasing trend of the involvement of females in agriculture, especially due to their characteristics such as patience and meticulousness (Ramadani *et al*., 2017; Sentuti *et al*., 2017). Previous studies on marital status, such as that of Siphesihle and

Mdoda (2020), agreed with this study's results. In most rural areas, farm owners are married, and this preference increases the likelihood of labourers available to work on the farm, i.e., the wife, husband and children, compared to a single farm owner. According to Muhammad *et al*. (2019), marriage in rural areas is highly esteemed, with unmarried people known to be irresponsible.

According to Zagata and Sutherland (2015), the total number of older farm owners in rural areas of Europe is relatively very high, and this trend is similar to the findings of this study; i.e. the majority of farms in the Western Cape are managed by farmers who are over the age of 50 years. Additionally, Wheeler et al. (2020) pointed out that farmers tend to retire late or not.

Education has several benefits, and the most important benefit is its important role with respect to the growth and development of sectors, including agriculture (Ashraf & Qasim, 2019). As shown in Table 1, 50% of the respondents had attained a qualification below the matric certificate. The remainder (50%) had either a matric, National Certificate or a tertiary qualification. However, a study by Magasi (2016) had contrasting results as the respondents in a study conducted in Tanzania on transition planning showed that 67% of respondents had tertiary qualifications.

TABLE 1: **Demographic Features of the Agribusinesses**

	Frequency	**Percentage**
Gender		
Male	27	64,29%
Female	15	35,71%
Total	42	100,00%
Marital Status		
Married	29	69,05%
Single	9	21,43%
Widowed	4	9,52%
Total	42	100,00%
Age of the business owner		
31-35 years	1	2,38%

36-40 years	3	7,14%
41-50 years	12	28,57%
51-60 years	20	47,62%
61 or older	6	14,29%
Total	42	100,00%
Educational level/qualification		
Grade R-8	9	21,43%
Grade 9-12	12	28,57%
Matric certificate	10	23,81%
National certificate (Vocational)	5	11,90%
Tertiary qualification	6	14,29%
Total	42	

3.2. The Existence of Estate Plans in Agribusinesses

Figure 1 shows the existence/availability of estate plans amongst FRKP agribusinesses in the Western Cape Province. Estate planning ensures that assets are inherited by the designated heirs and not through a verbal agreement. The study's findings show that 67% of the respondents highlighted that they do not have any form of plans regarding inheritance or succession plans, whereas 33% reported that there is an existing estate plan in place. Previous studies concerning issues relating to estate planning had similar results. A study by Earls and Hall (2018) and Lee *et al.* (2003) reported that only 21% of the agribusinesses interviewed had estate plans in place, while these studies also reported that no gender differences were noted for heirs.

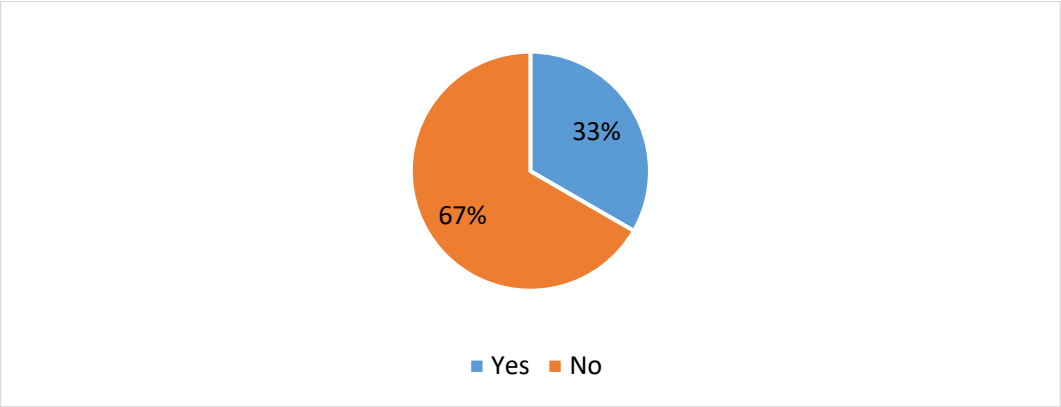

FIGURE 2: The Existence of Estate Planning in Agribusinesses

3.3. Retirement Plans and Awareness of Estate Planning by Agribusiness Owners

Table 2 shows agribusinesses' retirement plans and agribusiness owners' awareness regarding estate planning. It is noted by Wheeler et al. (2020) that retirement means something different to farmers compared to business owners in other sectors, and there may be different reasons why farmers opt not to retire or decide to retire at a certain age. It is further explained that most farmers view retirement as a concept for urban people because farmers view farming as a lifestyle rather than a business.

TABLE 2: The Existence of Retirement Plans and Knowledge of Estate Planning

	Frequency	**Percentage**
Retirement plans		
Yes	14	33,33%
No	28	66,66%
Total	42	100,00%
Knowledge of estate planning		
Yes	22	52,38%
No	20	47,62%
Total	42	100,00%

The study's findings, as demonstrated by Table 2 show that 67% of the respondents reported that they do not plan to retire from farming, while 33% reported that they would like to retire at an age of 62 years. The results of the study agreed with the study conducted in the United Kingdom by Wheeler et al. (2020), which showed that 19% of the farmers planned to retire at some point. In contrast, Earls and Hall (2018) had the opposite findings regarding retirement plans for farmers. The reasons provided by the FRKP farmers regarding retirement age included health issues because they believe that farming needs a person who is physically fit and healthy; thus, those over 60 years may not be in good condition to look after the farm. Some reported that they would have achieved their goals at 62 years. Concerning the awareness or knowledge of the estate planning process by agribusiness owners, the study showed that about 52% of the respondents reported that they had knowledge or were aware of the process of estate planning. In comparison, 48% mentioned

that they had never heard of it. A study by Bell and O'Mary (1986) had similar results about farmers' awareness of the estate planning process in Alabama, USA.

3.4. The Relationship Between the Size of the Business and the Existence of Estate Plans

The correlation between the size of the business (asset base) and the availability of estate plans is shown in Table 3. According to Ashok *et al*. (2004), the business's assets influence the business owner's decision on estate planning. This is the case because, in most instances, dairy or piggery businesses normally have more valuable assets than businesses that produce vegetables. In this study, a chi-square test was used to measure the degree of association between asset value and the existence of estate plans. According to Zafar and Akhtar (2020), a p-value lower than 0.005 in the chi-square calculation is considered significant, while a value of more than 0.005 is considered insignificant. According to the results of the χ^2 analysis, the correlation between the two variables is not statistically significant (χ^2= 2.46; df= 5; p= 0.782). The study's results disagree with studies by Ashok et al. (2004) and Wheeler et al. (2020), which noted an association between the likelihood of having an estate/succession plan and the size of a business. The difference in results could be that Ashok et al. (2004) focused on enterprises such as grains, dairy and piggery. In contrast, this study included all the different types of enterprises, i.e. aquaculture, vegetables, fruit, grains, beekeeping, small stock and large stock, and agriprocessing.

TABLE 3: Chi-Square Results for Asset Value and Availability of Plans

	Asset value (R'000)						
Availability of plans	**Less than R100**	**R100-R200**	**R200-R500**	**R500-R1000**	**R1000-R2500**	**Over R2500**	**Total**
Yes	0 (0%)	1 (7,1%)	2 (14,3%)	6 (42,9%)	2 (14,3%)	3 (21,4%)	14
No	1 (3,6%)	1 (3,6%)	6 (21,4%)	7 (25,0%)	7 (25,0%)	6 (21,4%)	28
Total	1 (2,4%)	2 (4,8%)	8 (19,0%)	13 (31,0%)	9 (21,4%)	9 (21,4%)	42

Chi-square (χ^2) = 2,46, df = 5, p= 0,7823.

4. CONCLUSION

Given the large number of family farms, passing over the farm business to the next generation and keeping it in the family is a very important characteristic in the agricultural sector. Farmers, however, find it very difficult to conclude concerning estate planning because these issues are emotional. It has been highlighted that the issue of passing over the farm to the heirs (younger generation) should not only be viewed as an exercise of arranging legal and financial affairs but also the passing of knowledge to potential successors. The study showed that farmers do not plan to retire from farming, while those few who plan to retire perceive 62 as a suitable age for retirement. In addition, the majority of the farmers do not have any estate plans in place, although the majority of the farmers are aware of estate planning and its processes. The correlation, as analysed by the chi-square test, showed no association between the availability of estate plans and the value of the assets owned by the agribusinesses. It is recommended that farmers normalise the process of estate planning. Farmers who plan not to retire should consider partial retirement, which might influence their decision to have plans in place in case of death. Further research should be conducted to investigate the impact of the non-existence of estate plans on the future operations of agribusinesses.

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Revolutionising the Public Extension System for Smallholder Livestock Farmers: User Experiences and the Prospects of Using Information and Communication Technologies in North West Province, South Africa

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ABSTRACT

The study aimed to determine farmers' and extension officers' experiences with public extension and the prospects of improving the public extension service through digital-based technology. Quantitative data were collected from 101 commercially oriented active beneficiaries of the Nguni cattle project in the North West Province, South Africa, using a structured questionnaire and analysed using descriptive statistics. Qualitative data were collected through focus group discussions (FGDs) and key informant interviews (KIIs) and analysed using thematic analysis. Ninety percent of the farmers regarded public extension as the key source of extension services received through farm visits (66%), telephone calls (65%), and visits to the extension offices (38%). Approximately 64% of respondents reported low visibility of extension officers in their farming areas. A very low extension officer-to-farmer ratio (typically 1:> 300) and a high demand for transport facilities were cited as constraints to service delivery by extension officers. The study showed that over three-quarters of the farmers had smartphones, with 89% having adequate smartphone operating skills. Approximately 80% had a strong positive perception of the usefulness of the proposed

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Livestock Management Database System (LMDS) in livestock production, while 84% were willing to pay to access the system. The results of the FGDs and KIIs also indicated high positive perceptions toward innovation. In conclusion, a digital-based platform was proposed to assist the public extension system in delivering well-coordinated extension and advisory services that would meet the needs of farmers cost-effectively.

Keywords: Public Extension System, Information and Communication Technologies, Smallholder Farmers, Willingness to Pay, Livestock Management Database System.

1. INTRODUCTION

Public extension significantly transforms the smallholder agricultural sector in South Africa (Trendov et al., 2019; Mapiye et al., 2021). Since the democratisation of South Africa in 1994, the country's agricultural extension system has attempted to move from a linear and top-down approach to a pluralistic and farmer-driven approach. The new orientation of extension service delivery became part of the envisioned transformation process for previously disadvantaged smallholder livestock farmers (Akpalu, 2013). The government took up a central role in driving the training and visit (T&V) approach toward smallholder farmers through its provincial departments of agriculture (Department of Agriculture, Land Reform and Rural Development [DALRRD], 2014; Koch & Terblanché, 2013). The T&V approach entails that the extension officers/advisors use a fixed schedule and travel to meet individuals or groups of farmers to share and disseminate agricultural technical information and technology (Mapiye et al., 2021).

The public extension system remains the largest and most common source of information for smallholder livestock farmers in South Africa (Ali, 2012; Mapiye et al., 2019). However, there is widespread concern that the public extension system is underperforming and has failed to effectively push the commercialisation agenda of the smallholder livestock sector (Food and Agriculture Organisation [FAO], 2017; Cook et al., 2021; Gwala et al., 2016). Most extension systems across Africa and Asia have attempted to move from supply-driven to demand-driven extension with little success (Davis & Terblanche, 2016; Duvel, 2000; Meena et al., 2013). This has prompted the need for new research and innovation strategies to revolutionise the extension approach.

A review of the literature suggests the potential of linking extension systems with information and communication technologies (ICT)-based strategies to promote and hasten farmer-farmer

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interactions and the ability of farmers to effectively communicate with extension officers and researchers (feedbacking) (Costopoulou et al., 2016; Ogbeide & Ele, 2015; Marwa et al., 2020). According to many studies (Meena et al., 2013; Qiang et al., 2012; Trendov et al., 2019), the adoption and use of ICTs, such as web-based and mobile applications (mobile apps) present unprecedented opportunities for transforming smallholder farming through access to timely and relevant information and services. Therefore, the continued development and implementation of innovative strategies in revolutionising public extension services are essential (Wesley & Faminow, 2014). This study sought to provide evidence on the experiences and challenges of accessing extension services and the prospects of using ICTs to drive the revolution of extension service delivery. The reason for the interest in this topic is that an effective agricultural extension system is one aspect that brings long-term sustainability to the agricultural sector in general and the smallholder livestock sector in particular.

2. MATERIALS AND METHODS

2.1. Description of Study Area

The study was carried out in the four districts of the North West Province, South Africa (Table 1). The study sample constituted 101 commercially oriented smallholder cattle producers actively participating in the North West Industrial Development Corporation (IDC) Nguni cattle programme. Key informant interviews (KIIs) and focus group discussions (FGDs) were conducted to gain a deeper understanding of the study questions and to validate the quantitative results. The FGD participants were purposively selected from the survey sample with assistance from local extension advisors. They were based on gender, age, production level (herd size), and location to ensure diverse perspectives. The key informants were livestock extension officers working with the studied farmers across the province's four districts. They were identified with the assistance of district extension advisors. Table 1 shows the distribution of the respondents in the province. The study was guided by a pragmatic paradigm that accommodated positivist (quantitative) and social constructivist (qualitative) perspectives (Creswell, 2014). A partially mixed sequential design with the dominant quantitative method (survey) was adopted.

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TABLE 1: The Distribution of Study Respondents across the Province

District Municipalities	No of FGDs	No of KIIs	Local Municipalities	No of Farmers
Dr Ruth Segomotsi Mombati			Greater Taung	1
			Kagisano-Molopo	22
	1	1	Naledi	2
Ngaka Modiri Molema	1	2	Ditsobotla	1
			Mahikeng	11
			Ramotshere Moiloa	3
			Ratlou	1
			Tswaing	5
Dr Kenneth Kaunda	1	2	Matlosana	7
			JB Marks	18
			Maquassi Hills	1
Bojanala Platinum	1	1	Kgetleng river	8
			Madibeng	8
			Moretele	2
			Moses Kotane	7
			Rustenburg	4

2.2. Quantitative Data Collection

A pretested structured questionnaire was administered to collect quantitative data through individual farmer interviews between November 2020 and February 2021. Five trained enumerators assisted in conducting the interviews using the local language (Setswana) to enable the farmers to understand correctly and respond comfortably. Data collected included the farmers' primary source of extension services, their experiences in receiving the services,

and the use of ICTs. The study gathered data on respondents' perceptions regarding the usefulness of the proposed LMDS and their willingness to pay (WTP) to access the system.

2.3. Qualitative Data Collection

Four FGDs were conducted with groups of 5-7 farmers at the DALRRD's district centres and lasted approximately one hour. The FGDs explored the farmers' experiences in receiving the extension services and using ICTs and their perceptions of the usefulness of the proposed LMDS technology. An FGD facilitator was hired to moderate the discussions, and an interview guide was developed to facilitate the discussions. The KIIs captured in-depth information and insights about agricultural extension delivery. A high-quality audio recorder was used to record the FGDs and KIIs, which were later transcribed verbatim by the researchers.

2.4. Statistical Analysis

Descriptive statistics were used to analyse the quantitative data using the PROC FREQ procedure of the Statistical Analytical System (SAS) (SAS Institute, 2012). A thematic analysis framework was computed to analyse qualitative data following the procedure set out in Braun and Clarke (2006) and Mauire and Delahunt (2017) using the Atlas-ti V8 software. Thus, a theory-driven (inductive) thematic analysis involving the use of the specific research question(s) in the interview guides (Neuman, 2007) and the analyst's focus was employed. The steps included familiarisation with the data sets through reading and rereading the transcripts and generating codes. The codes were collated into potential themes aligned with the study areas. Each theme's clear definitions and names were generated based on the available categories, followed by formulating how the themes could come together into a narrative. Lastly, interpretive analysis was conducted by formulating arguments from the qualitative results to support and validate findings from the quantitative study.

3. RESULTS AND DISCUSSION

3.1. Farmers' Demographic Characteristics

Table 2 profiles the farmers' demographic characteristics. Male farmers dominated the study sample. Generally, male farmers have better access to means of production and income than female farmers (Gosbert et al., 2019). Despite women performing significant roles within these systems (Usman et al., 2022), their limited participation and access to resources and incomes can significantly hinder the adoption of technologies among smallholders. Half of the

respondents were above 55 years old, with only 6% being less than 53. The demographic trend regarding age indicates low participation by youths in farming. This aligns with a study by Kimaro et al. (2015) that found low levels of engagement and a lack of interest in agriculture among young people. Poor participation by young people in farming could inhibit the introduction of modern farming technologies such as ICTs. Nearly 70% of the respondents had at least secondary education. Most respondents were full-time farmers, with average farming experience being 19 years. Invariably, better education and long tenure can enhance farmers' productivity and promote a more positive attitude toward and understanding new technologies. This finding aligns with previous studies (Kabir, 2015; Shemfe, 2018; Agholor & Ogujiuba, 2021) by suggesting that better education and more farming experience positively influence the adoption of ICTs.

TABLE 2: Characteristics of Commercially Oriented Smallholder Cattle Farmers in North West Province, South Africa

Variable	Category	%
Gender	Male	74
	Female	26
Marital status	Single	21
	Married	65
	Divorced/widowed	14
Household size	Below 3	15
	3-5	44
	6-8	34
	Above 8	7
Farmer's highest education level	No formal education	3
	Primary education	28
	Lower secondary education	8
	Higher secondary education	32
	Postsecondary/technical education	18
	Higher tertiary education	11
Farmer's age (years)	Below 35	6

	35-44	21
	45-54	23
	55-64	24
	Above 65	26
Farming engagement/employment	Full-time farmer	95
	Part-time farmer	5

3.2. Methods of Accessing Extension Services

The current study revealed that over 90% of the farmers relied on public extension services, while a few used private extension (7%) and full-time farm managers (3%). This finding corroborates Eicher (2007) and Raidimi and Kabiti (2019), who indicated that public extension was the largest and most common source of information for smallholder livestock farmers in developing countries. Ali and Haider (2012) and Mapiye et al. (2019) further asserted that public extension was a promoter of technology adoption by farmers and a potential bridge to the farmer-researcher linkage. South Africa's DALRRD, through its provincial departments, has a *de facto* monopoly over providing extension and advisory services (Akpalu, 2013; DALRRD, 2014; Koch & Terblanché, 2013). Due to the existing relationship between smallholder farmers and government extension officers, introducing new technologies requires active collaboration with extension officers to establish trust among the end users (Costopoulou et al., 2016; Karanja et al., 2020). Furthermore, the studied farmers indicated that they mainly received extension services through farm visits by extension officers (66%), telephone calls (65%), and visits to the extension offices of the DALRRD (38%). The following quote from the FGDs shows the primary source and channel used for receiving extension services by the farmers:

> "… our extension services come from the government. This is through the likes of Mr XXX and his colleagues. They sometimes visit my farm and advise on the areas I need help. It could be on management or production issues … we call to meet them, and we sometimes rely on WhatsApp to get updates from them."

The extension officers confirmed that their primary role was to provide farmers with information and technical advice on livestock production. They also highlighted some of the various channels that they used to deliver services, as evidenced by this quote:

> "… We provide technical advice to the farmers daily by visiting their farms. We also perform routine livestock husbandry procedures like ear tagging, branding, ear notching etc. Normally, we bring them together as a group of ten and demonstrate to them. We do farmers' days and information days where we link our farmers with external stakeholders or call specialists from organisations like North-West University, and Agricultural Research Council (ARC) so that they can demonstrate new ideas and programmes ..."

The current finding that extension officers provide technical advice to farmers through farm visits conforms with the literature (Duvel, 2000; Hanyani-Mlambo, 2002; Loki et al., 2020). Farmers may incur high costs due to driving to extension offices and making phone calls to find information and technology, which can result in less quality information available. Consequently, a lack of appropriate information makes it harder for the farmers to make sound and timely management decisions, especially in responding to risks and challenges and leveraging the available opportunities to grow their business (Mbanda-Obura et al., 2017; Myeni et al., 2019).

3.3. Challenges with the Public Extension Services: Farmers' and Extension Officers' Perspectives

Despite public extension being the primary source of agricultural services, there is a widespread concern that it has remained limited in transforming smallholder farmers into commercial farmers. In this study, farmers indicated the low visibility of extension officers (64% of respondents), with the average number of farm visits being four times a year. Moreover, farmers claimed a low response rate (66%) from extension officers, citing instances of the officers being unable to arrive on time due to other commitments. The limited access to extension services implies that farmers fail to receive timely and tailored assistance and cannot effectively provide feedback to the extension system (Van Schalkwyk et al., 2017).

To validate this assertion, feedback from extension officers shows that one of the pervasive constraints to their service deliverables is the very high farmer-to-extension officer ratio (typically > 300:1). This work ratio practically prevents extension officers from visiting and supporting a sufficient number of farmers at a given time, hence the failure to meet the information and technological needs of the farmers. The extension system employs the T&V approach, which is when extension officers visit farms to provide services. This is proving very costly to the government as it requires much human capital and transport resources. For

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instance, some extension officers reported sharing one car as a group of four, which often hindered their day-to-day planning and effectiveness in service delivery. These findings conform to those of many previous studies showing that public extension systems in developing countries are heavily under-resourced and overstretched, lack skilled human resources and infrastructural support, and face an overall decline in investment (Baig & Aldosari, 2013; Davis & Terblanche, 2016; Gwala et al., 2016; Cook et al., 2021). Additionally, the extension officers lack up-to-date data information on livestock numbers, farmer performance, and challenges faced by farmers, which affects their mechanisms and policy decisions, leading to the creation of solutions that fail to meet the needs of farmers on the ground.

3.4. Farmers' Experiences of Using Information and Communication Technologies

Over three-quarters of the interviewed farmers had smartphones, with 89% having medium to high smartphone operating skills (Table 3). Extension officers concurred that most farmers, especially emerging ones, had smartphones and laptops. Furthermore, when asked about the applications that they used with farmers, one extension officer responded as follows:

> "In terms of Apps, we mainly use WhatsApp to share and discuss things. For example, yesterday, there was a discussion on one of my groups with farmers. We were discussing how to handle broilers this coming winter with farmers advising one another on how to go about the process."

The findings on smartphone ownership and use by smallholder farmers are supported by many previous studies (Kabir, 2015; Kassem et al., 2021; Masuka et al., 2016; Shemfe, 2018), confirming the ICT revolution in Africa. Wyrzykowski (2020) notes that the increasing adoption of smartphones could be attributed to the increased availability of mobile phones and a decline in their prices in local markets. The proliferation of smartphones and the provision of mobile broadband are key factors driving internet use and, hence, access to digital-based technologies (Qiang et al., 2012). The study found that nearly two-thirds of farmers already used the Internet to search for agricultural-related management and marketing information and services. This conforms to the findings by Dehnen-Schmutz et al. (2016) and Khan et al. (2019), who argued that internet-connected smartphones allowed farmers to access large amounts of agricultural information, technologies, and services available on websites, in e-magazines, on internet portals, and social media platforms.

About 80% of the farmers strongly agreed that the LMDS would help them access agricultural information and manage livestock effectively. The findings of this study are supported by those of Kivunike et al. (2011) and Shemfe (2018), who asserted that farmers perceived ICTs as valuable tools for driving their farming and changing the quality of rural life. In addition to the positive assessment of the LMDS through farmers' perceptions, the results of the WTP study further revealed a very high level of users' appreciation of the innovation. Asked whether they would be willing to pay a full subscription fee, 84% of the farmers showed positive WTP (Table 3). A recent study by Hidrobo et al. (2020) also found that farmers had positive WTP for accessing digital-based agricultural and nutrition services. Moreover, the studied farmers were spending an average of R700 (USD39.32) on mobile subscriptions, which suggests the possibility of their paying a yearly subscription, ensuring the sustainability of the LMDS.

TABLE 3: Experiences with and WTP for ICT Innovation and the Perceived Constraints

Item	Percentage
Smartphone ownership among farmers	75
Smartphone operating skills (digital skills)	89
Perceived impact of LMDS innovation	80
Using internet to access agricultural information	67
WTP subscriptions for using LMDS	84

3.5. Perceived Constraints to the Use of Information and Communication Technologies

Figure 1 presents the perceived constraints to farmers' adoption of the proposed innovation. Over 40% of respondents reported poor availability of network connectivity. Improved mobile coverage complements the entire functioning of mobile phones, hence the adoption and operationalisation of ICTs for supporting smallholder farming systems (Trendov et al., 2019). The current finding on poor connectivity agrees with a previous report by the Global System for Mobile Communications Association (GSMA), formerly the Groupe Spéciale Mobile (2019), indicating that the African region still accounts for 40% of the world population not covered by the mobile broadband network. Kabir (2015) and Smidt (2021) also reported that farmers within rural areas had unstable network connectivity.

About 20% of farmers perceived a lack of digital skills as a constraint to adopting and using ICTs in agriculture. For example, when asked to comment on skills level during the FGDs, one of the farmers stated:

> "… I do not use technologically advanced phones because I do not have the skills. I use a simple phone that makes calls, that is all. However, I have a son who can assist me with other technical issues like mobile Apps, so there will not be a problem from my side."

Owning a mobile device and having access to connectivity may not be sufficient to justify the productiveness of the devices among farmers. Instead, farmers' skills level in operating a smartphone and understanding its features is critical (Quandt et al., 2020). Many studies have shown that illiteracy and lack of digital skills among smallholder farmers and, in some cases, extension officers constrain the use of ICTs (for example, Messenger, 2018; Trendov et al., 2019). Most farmers in the current study had a relatively high level of education, which suggests better skills in using new technologies. Fostering better education and appropriate digital skills, especially among youths, women, and the elderly, will be essential in keeping pace with digital transformation and building digital societies (Steinfield & Wyche, 2013; Trendov et al., 2019). Additionally, factors such as low participation by youths and women in farming, as found in this study, could negatively impact the adoption and use of improved technologies (Wordofa et al., 2021).

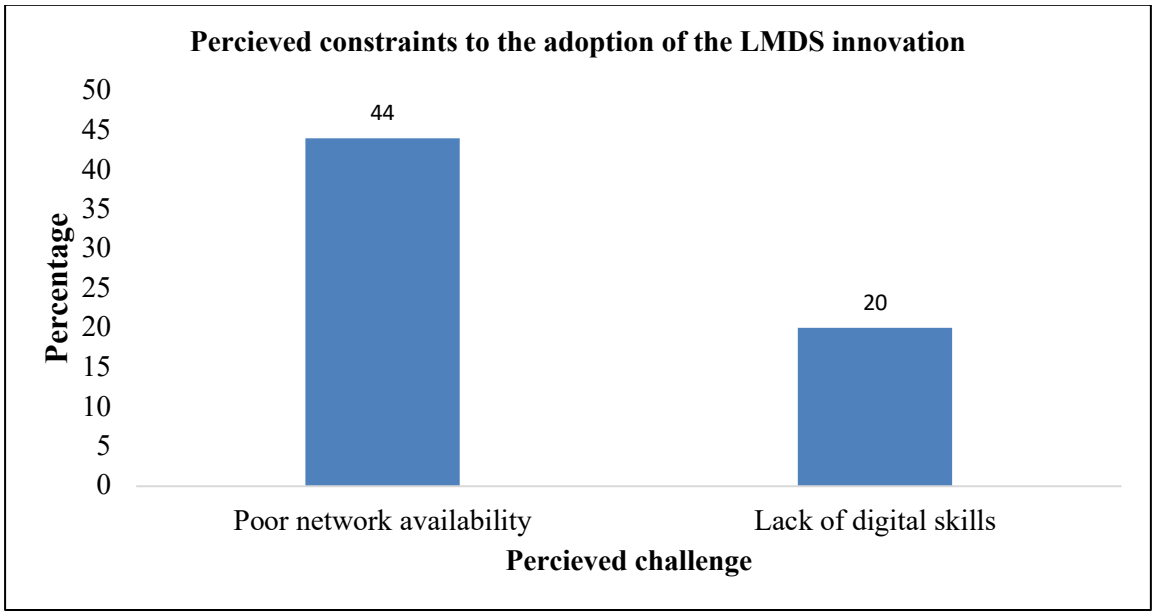

FIGURE 1: The Perceived Constraints to the Adoption of the LMDS by the Farmers

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3.6. Potential for the Application of Information and Communication Technologies in Revolutionising Agricultural Extension

The provision of extension services has continued to evolve, with efforts pointing to the application of ICTs (Marwa et al., 2020; Meena et al., 2013). The research discourse in this area already underscores the potential for ICTs in improving the provision of relevant information and agricultural services to smallholder farmers (Costopoulou et al., 2016; Marwa et al., 2020; Ogbeide & Ele, 2015). Thus, smallholder farmers can benefit from innovative and far-reaching digital measures to address the extension service challenges (Mapiye et al., 2021). The proposed LMDS is an example of such innovation. The LMDS is an innovation from a PhD research study performed in the Department of Animal Sciences at Stellenbosch University (SU) between 2018 and 2022. The study conceptualised a solution to assist emerging farmers in achieving sustainable growth into commercial farmers. Figure 2 presents the schematic representation of the tool and how it will connect farmers with extension and various agri-value chain players. It is a user-driven mobile phone application and web-based suite accessible through smartphones and computers. Its specific goals are to provide emerging livestock farmers with customised information and services tailored to their needs. Thus, the system allows the farmers to share challenges, experiences, data, information, technologies, and services with their colleagues and have timely access to actionable solutions without travelling or spending too much on airtime as they currently do. In addition, the LMDS will assist the government in the timely and cost-effective delivery of well-coordinated extension and advisory services that meet the farmers' needs and goals.

In 2020, the LMDS intervention was disclosed to SU's Innovus and was accepted for commercialisation. Innovus is the technology transfer office of SU, which is responsible for commercialising innovative ideas resulting from research and development at the University.

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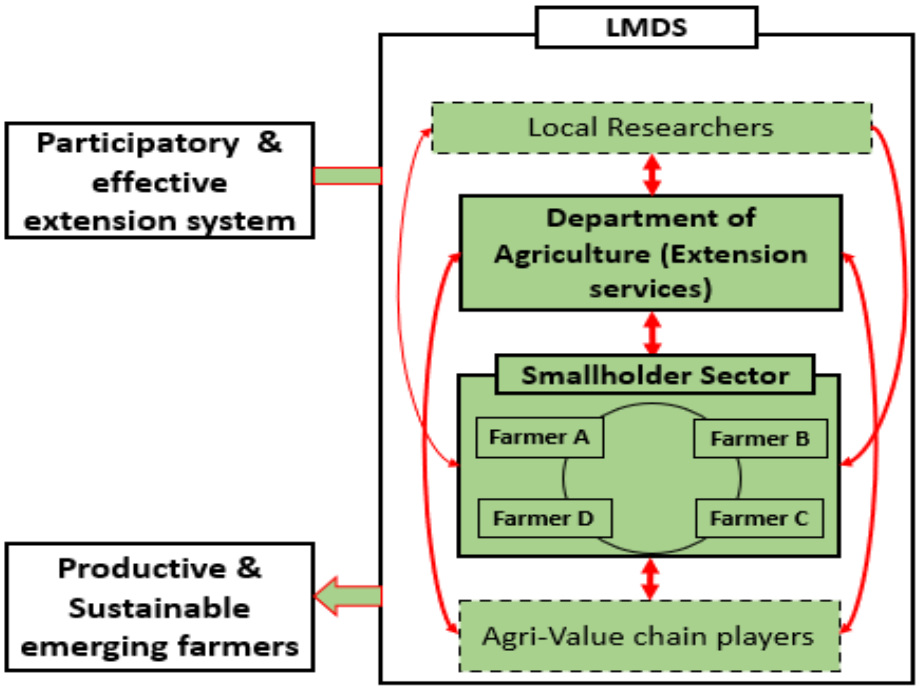

FIGURE 2: A Schematic Representation of the LMDS

The LMDS was developed by understanding the specific needs and preferences of the targeted users, namely farmers, and by gaining opinions from agricultural extension officers. This makes it an immersive and user-centric intervention that meets the targeted users' expectations (Asare-Kyei, 2013). It is important to involve end-users directly in developing new agricultural innovations since this increases trust among them, making the innovation less reliant on donor funding (Van Zyl et al., 2014).

4. CONCLUSIONS

The study results show that public extension is the primary source of extension services for farmers, who can access the services through farm visits and telephone calls. However, farmers and extension officers have reported that the public extension service has remained limited in providing services to help smallholders improve their productivity. The extension officers can only provide services to a few farmers because of the high farmer-to-extension officer ratio. Furthermore, since the government relies on the T&V approach, extension officers cannot visit some farmers due to limited support resources. Lack of direct and two-way communication between farmers and other experts, such as researchers, worsens this situation. The study findings illustrate that all farmers had mobile phones, with most having smartphones and the skills to operate the gadgets. Farmers had experience using ICTs and positive perceptions of

the proposed LMDS, suggesting the likelihood of farmers adopting mobile-based technologies. However, limited network connectivity and digital skills have implications for farmers' adoption and usability of the technology, and therefore, these issues should be addressed. In conclusion, the study results provide key insights that will help researchers, development agents, and policymakers develop digital-based intervention strategies to revolutionise public extension systems in South Africa and developing countries.

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An Entrepreneurship Framework for Improved Productivity and Financial Performance of Primary Agricultural Cooperatives in North West Province

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ABSTRACT

The study was conducted to establish an entrepreneurship framework for the improved productivity and financial performance of agricultural cooperatives in South Africa. For this reason, a sample of twenty-nine (29) agricultural cooperatives were selected in the North West Province using the snowball sampling method. Descriptive analysis was used to assess the nature and characteristics of primary agricultural cooperatives from the views of the cooperative managers. The results were presented using the general frequency distribution, and a summary of the descriptive analysis, such as frequencies and percentages, is illustrated using graphs, charts, and tables. Productivity was tested using a stochastic frontier, and three financial ratios (liquidity, solvency, and profitability) were used to measure financial performance. The study's findings assert that most of the agricultural crop cooperative managers are older men with primary education as the highest qualification, which is the lowest level of education. Moreover, the study finding from the stochastic frontier measure of technical efficiency revealed that the predicted technical efficiency varies slightly among cooperatives, with a minimum value of 0.9920, a maximum value of 0.9922, and a mean efficiency of .9920437. According to the results, the distribution of the technical efficiency shows that 100% of the sampled cooperative's technical efficiency skewed in the 0.90-1.00 range. It also identified that financial performance was the main contributor to the performance of the crop cooperatives. Moreover, the study's findings were used to formulate the proposed entrepreneurship framework, which will help improve the performance of

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agricultural cooperatives and affiliated members (smallholder farmers). The developed entrepreneurship framework suggests that agricultural managers should have management skills, opportunity skills, and networking skills to be entrepreneurial. By exploring these sets of skills, entrepreneurs will be developed in the agricultural value chain. Furthermore, this framework suggests that financial performance is the main contributor to crop cooperatives' performance.

Keywords: Agricultural Cooperatives, Performance, Productivity, Entrepreneurship Skills

1. INTRODUCTION

Entrepreneurship is an important channel for bringing about transformation to sustainable products and processes, complimented by several high-profile thinkers promoting entrepreneurship as a possible solution for many social and environmental concerns (Hall, Daneke & Lenox, 2010, as cited by Kavari, 2016). Different institutional bodies (researchers, advisory services, policymakers, and farmers' unions) are all working towards developing entrepreneurship in agriculture and trying to find answers to questions on the relevance of entrepreneurship in agriculture.

South African agriculture plays a significant role in the development of the economy and in ensuring food security at the household level (DRDLR, 2019). The importance of the concept of sustainable development of the economy has been an ongoing debate for some time, and entrepreneurship is continuously being cited as a significant channel in addressing social and environmental concerns and for bringing a transformation to sustainable products and processes (Hall, Daneke & Lenox, 2010). In this context, entrepreneurship is defined by Ahmad and Seymour (2008) as a phenomenon that seeks to generate value through the creation or expansion of economic activity by identifying and exploiting new products, processes, and markets. According to Christian (2014), there has been little research on the field of entrepreneurship due to aspects such as the communal structure, framework, and formal definitions of constructs, and hence, there is no definite direction concerning the future of entrepreneurial research.

The South African economy faces the challenge of increasing the number and variety of viable and sustainable economic enterprises (DTI, 2004). The majority of the enterprises or cooperatives that were registered about a decade ago are inoperative now due to this challenge

(DAFF, 2015). The development of these enterprises is interrupted by South African history, such as the racial history and the destruction of wealth in black hands located both in rural and urban areas. DTI (2004) states these negatively affect income distribution, employment creation, and entrepreneurship. The success of such enterprises relies on the environment in which they operate, and in most cases, it is affected by factors beyond the farmers' control. In less-developed countries, smallholder farmers are known to be the drivers of agricultural development (Machethe, 1990). Thus, Delgado (1998) argues that "smallholder agriculture is simply too important to employment, human welfare, and political stability in Sub-Saharan Africa to be either ignored or treated as just another small adjusting sector of a market economy" (as cited by Chibanda, Ortmann & Lyne, 2009). Policies made by the government and agricultural investments have a greater influence on the environment, which is why the entrepreneurial environment differs from country to country (Kahan, 2012).

Agricultural cooperatives are promoted to boost smallholder farmers' productivity (Christian, 2014) and to equip them with entrepreneurship skills. The SA government promotes the use of these cooperatives as an organisation that can help to enhance the development of small-scale farmers and the communities around South Africa. A new Cooperatives Act (No.14 of 2005), which is based on international cooperative principles, was lawfully signed by the SA government in August 2005. This particular Act foresees a major role for cooperatives in promoting social and economic development, "more especially by creating employment, generating income, facilitating broad-based black economic empowerment and eradicating poverty" (RSA, 2005). The SA government has also committed and pledged itself to provide a supportive legal environment for cooperatives.

North West province has 222 registered agricultural cooperatives, of which only 215 are agricultural-related and constitute 13% of the total number of cooperatives found in the country (DAFF, 2015). Only 40% of the total cooperatives are classified as operational and expanding, and 23% are operational and stable. These cooperatives play a significant role through their contributions (production and employment) to the provincial and national economies. The province is well-known for producing crops and livestock; therefore, the highest number of cooperatives in the province are involved in the production of these two commodities (52 and 60, respectively), and the second dominant commodities are mixed farming, poultry and vegetables with 30 cooperatives each (DAFF, 2015). According to DAFF (2015), the estimated provincial turnover by local sector cooperatives has decreased destructively by more than 85%

from the previous period (2013/14), which signifies poor financial performance within the province, even though the increase in cooperative number has been recorded. Therefore, the main objective of this study was to develop an entrepreneurship framework that aimed at improving the productivity and financial performance of the primary agricultural cooperatives (crops) in Ngaka Modiri Molema district of the North West province.

2. DEFINITION OF THE PROBLEM

Entrepreneurship is a key factor for the survival of small-scale farming, which operates in an ever-changing and increasingly global economy (Kahan, 2012). Farmers see their farms as a business, a means of earning profits in agriculture. They are more than willing to take risks and grow their farms to generate profits from their farm operations. Therefore, they need a framework to help them understand the agribusiness environment and become innovative. To increase the chances of survival for small-scale farmers, they should become more entrepreneurial, increasing their production for markets and profits.

The entrepreneurial activity of South Africa is low compared to other countries that are still developing (DAFF, 2012; GEM, 2020). This is because most of the farmers in South Africa operate on a small scale (Ortmann & King, 2007). Makhura (2001) and Moloi (2010) are of the same view; they assert that most of the farmers in SA are subsistence farmers located in semi-arid areas that are overpopulated. According to DAFF (2015), these farmers face challenges such as low productivity and poor access to inputs, which may hinder them from being more productive in the markets and enhancing their revenues.

The ever-changing environment of farms forces farmers to develop their farm business economically for their survival and success (de Wolf & Schoorlemmer, 2007). Therefore, there might be a need to develop an entrepreneurial framework, which may assist cooperatives in developing corrective measures to ensure that smallholder farmers are equipped with entrepreneurial skills and have equal and satisfactory opportunities to access their respective production and marketing needs. This will increase the province's performance on the ideals of the National Development Plan (NDP 2025). It will also satisfy the mission of the Department of Agriculture, Forestry and Fisheries, which is to achieve the “advanced food security and transformation of the sector through innovative, inclusive and sustainable policies” (DAFF, 2017). To achieve this objective, the cooperative sector must increase the quality of cooperative, entrepreneurship education. The study carried out in Latvia by Zvirgzdina et al.

(2009) pointed out that farmers' productivity was low because there were considerable areas of unutilised agricultural land in Latvia. Land is also one of the significant production factors that may have a greater impact on the productivity of smallholder farmers.

There have been several studies about cooperative entrepreneurship in South Africa, such as those by Griffin and Oosthuizen (2016), Kavari (2016), and Modiba (2009), but none of them have ever developed an entrepreneurship framework. This study intends to fill this gap by creating an entrepreneurship framework to improve the productivity and financial performance of primary agricultural cooperatives, especially in the North West province. Thus, this framework aligns with goals 2 and 4 of the Sustainable Development Goals 2030 (SDG). Goal 2 aims to "By 2030, double the agricultural productivity and incomes of small-scale producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment". In contrast, goal 4 aims to "substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship" (UN General Assembly, 2015).

The study's main objective is to develop an entrepreneurship framework that can improve primary agricultural cooperatives' productivity and financial performance in the North West Province. Thus, the study aims to achieve this by assessing the nature and characteristics of primary agricultural cooperatives in the North West Province, assessing the current level of productivity and financial performance of primary agricultural crop cooperatives, and exploring the relationship that exists between the entrepreneurship skills of cooperative managers and cooperative performance.

3. RESEARCH METHODOLOGY

3.1. Overview of the Study Area

The study will be conducted in Ngaka Modiri Molema District of the North West Province (the central region). The size of Ngaka Modiri Molema District of the North West is 28 114 km square. It comprises 27% of the total area of the province, with a population of 885 737, which comprises 23% of the province's population. The district includes five local municipalities Mahikeng, Ratlou, Ramotshere Moiloa, Ditsobotla, and Tswaing. The province is dominated by villages with fewer suburbs (Msimango & Oladele, 2013), and the province's capital city is

Mafikeng (Stats SA, 2018). Agriculture is the major provider of many households in the province, and the province's main economic activity is the production of livestock and crops. The province has 215 cooperatives under the agricultural sector, and the highest number of cooperatives in the province are involved in livestock and crop farming, followed by mixed farming, poultry, and vegetables (27%, 23%,14%, 14%, and 14%, respectively) (DAFF, 2015).

3.2. Sample and Sampling Techniques

The sample is known to be the true representative of the target population, and general observations about the population can be made by studying the sample (Goddard & Melville, 2001). The sampling procedure employed was a non-probability sampling method called snowball sampling. According to Etikan and Bala (2017), this method is useful and is mostly employed when the researcher does not know much about the study population; therefore, contact with a few individuals will direct him to the other group. This is mostly used when no complete population size or frame of reference. There was a limitation concerning obtaining the database of primary agricultural cooperatives within the study area; therefore, there was no complete population size. A database of cooperatives obtained from the North West Department of Agriculture and Rural Development (NWDARD) was not filtered according to provinces and districts. Therefore, cooperatives were selected randomly from the entire country's unfiltered list of primary crop cooperatives. The agreeable participants based in the district to be studied were then asked to recommend other contacts who fit the requirements and might also be willing to participate in this study, who also recommended other potential participants, and so on (Etikan & Bala, 2017).

The study was conducted in one of the North West province districts, Ngaka Modiri Molema District. Agriculture is the major provider of many households in this district, and crop production is the main economic activity. The district has five municipalities: Mahikeng, Ratlou, Ramotshere Moiloa, Ditsobotla, and Tswaing. Therefore, only agricultural crop cooperatives under those municipalities participated in the study. Due to time limitations and distance not all could be reached; the number of crop cooperatives that participated in the study was 29 agricultural crop cooperatives, which served as the sample size of the study.

3.3. Data Collection

Primary data was collected using a semi-structured questionnaire to obtain qualitative and quantitative data. Unlike an unstructured questionnaire with open-ended questions, a structured questionnaire has closed questions (Cooper & Schindler, 2008). This questionnaire, which included only closed-ended questions, was given to the cooperative managers who used the chosen sample to gather data for the study. The questionnaire employed Likert-type scales and a five-point response format. Respondents were asked to rate their skill level on a scale of 1 to 5, with 1 representing no skill at all and five denoting very high proficiency. According to Kavari (2012), the Likert scale is the most effective method for gauging people's attitudes, conceptions, pictures, perceptions, and views.

3.4. Data Analysis

3.4.1. Descriptive Analysis

The descriptive analysis was used to describe and profile the nature and characteristics of smallholder agricultural cooperatives in Ngaka Modiri Molema district. To emphasise the nature and characteristics of the cooperatives from the views of the cooperatives' management to analyse the data acquired from the sampled managers. The results were presented using the general frequency distribution, and a summary of the descriptive analysis, such as frequencies and percentages, is illustrated using graphs, charts, and tables. To assess the current level of productivity and financial performance of primary agricultural cooperatives, the study used the stochastic frontier and three financial ratios (Liquidity, solvency, and profitability).

3.4.2. Inferential analysis: Canonical Correlation Analysis Model specification

3.4.2.1. Canonical Correlation Analysis

The study employed canonical correlation analysis to explore the relationship between entrepreneurship skills and cooperative performance (profitability and financial performance).

The canonical correlation studies the relationship between two sets of variables.

$(X1, \ldots, Xr)$ and $(X1, \ldots, Xs)$ ….(1)

It requires that each set of variables should be reduced to a single variable and, thereafter, find their correlation. These variables can be found by forming linear combinations of the variables in each set under certain pre-fixed criteria. The variables obtained from the linear combinations

are known as 'canonical variables', and the correlation between them is known as 'canonical correlation'.

Suppose:

$(X1i, X2i)$ for i = 1, …, n i.e we have n × (r + s) data matrix.

Let there be r- variables in the 1st group: $X1 = (X1, \ldots, Xr)$ and ….(2)

s-variables in the 2nd group: $X2 = (Xr{+}1, \ldots, Xr{+}s)$ ….(3)

Assume without loss of generality: r ≤ s.

Also let,

$E(X1) = \mu 1$ and $E(X2) = \mu 2$ ….(4)

Var $(X1) = \Sigma 11$, Var $(X2) = \Sigma 22$ and Cov $(X1, X2) = \Sigma 12$ ….(5)

Define: m = r + s

X = ($X1$ $X2$) ….(6)

E(X) = ($\mu 1$ $\mu 2$) and . …(7)

Cov (X) = ($\Sigma 11$ $\Sigma 12$ $\Sigma 21$ $\Sigma 22$) ….(8)

$\Sigma 12$ contains rs elements which gives the correlation between each variable of set 1 with those of set 2

For r and s dimensional coefficient vectors **a** and **b,** define

U = a'$X1$ and V = b'$X2$ …. (9)

Then Var (U) = a'$\Sigma 11a$, Var (V) = b'$\Sigma 11b$ …. (10)

and Cov (U, V) = a'$\Sigma 11b$ …. (16)

so that Corr (U, V) = $a'\Sigma 11b\sqrt{a'\Sigma 11a}\ \sqrt{b'\Sigma 22b}$ …. (11)

The 1st pair ($U1'$, $V1$) is chosen to maximise Cov (U, V), while the 2nd pair ($U2'$, $V2$) are chosen to maximise Cov (U, V) subject to their combinations being orthogonal to the 1st choice.

In general, the jth pair (Uj, Vj) are chosen to maximise Cov (U, V) subject to their combinations being orthogonal to the previous (j-1) choices.

This can be done till j = r

Therefore, (U, V) are canonical variables, where U = a'$X1$ and V = b'$X2$ …. (12)

$X1$ represents cooperative performance variables (Financial performance and Productivity), whereas

$X2$ represents the entrepreneurship skills (Professional skills, Management skills, Opportunity skills, Strategic skills, and Co-operation/Networking skills)

"a" and "b" are coefficient vectors.

TABLE 1: Model Specifications for Canonical Correlation Analysis

Variables	Description	Unit of	Exp. sign
Dependent variables			
Productivity Financial Performance			
Independent variables			
Professional skills	1= not at all skilled 2= slightly skilled 3= moderately skilled 4= skilled 5= very skilled	Scale variables: Ordinal scale	+/-
Management skills		Scale variables: Ordinal scale	+/-
Opportunity skills		Scale variables: Ordinal scale	+/-
Strategic skills		Scale variables: Ordinal scale	+/-
Co-operation/ Networking skills		Scale variables: Ordinal scale	+/-

4. RESULTS AND DISCUSSION

This section is divided into two sections: the descriptive results of the primary agricultural cooperative managers and the inferential results.

4.1. Demographic Information

Demographic information assists in determining the extent to which they influence the managers' response in the study. The demographical information discussed in this section includes age, sex, marital status, past working experience, highest qualification, and entrepreneurship alertness. Table 2 shows the demographic information of cooperative managers.

TABLE 2: Demographic Information of Sampled Cooperatives' Managers

	Frequency	Percentage
Sex		
Male	18	62.07
Female	11	37.93
Marital Status		
Single	8	27.59
Married	6	20.69
Divorced	5	17.24
Widowed	10	34.48
Past working experience		
Unemployed	0	0.00
Self-employed	4	13.79
Worker	4	13.79
Farm worker	12	41.38
Supervisor	6	20.69
Middle-management	3	10.34
Top management	0	0.00
Other	0	0.00
Period(years) in current position		
1-2 years	10	34.48
3-6 years	14	48.28
7-10 years	5	17.24
10+ years	0	0.00
Highest qualification		
No qualification	0	0.00
Primary school completed	14	48.28
High school completed	3	20.69

Post Grade 12 certificate	5	17.24
Post Grade 12 diploma	0	0.00
University degree	3	10.34
University Post Grade degree	1	3.45
Other	0	0.00
Entrepreneurship alertness		
Alert	5	17.24
Non-alert	24	82.76

The findings of the study showed that most (72%) of the agricultural cooperative managers are between the ages of 45-60 and that there is only one manager (3.45%) who is considered to be youth (less or equal to 35 years of age). Moreover, the study's findings suggest that managers of agricultural crop cooperatives are mostly older. This is in line with Gotyi (2019), who confirmed that most cooperatives are usually formed by pensioners. According to a study conducted by Black (2020), the results from the interviewed participants suggest that women entrepreneurs lack confidence and self-belief. Therefore, the results of this study shown in the table, show that most of the respondents were male, with a share of 62.07% compared to 37.93% females. This can also be attributed to the fact that the active gender in agriculture is male (Stats SA, 2021); therefore, most of the respondents were likely to be males. According to the results, there are four main groups: single, married, divorced, and widowed. Table 2 shows that most of the managers are widows (34.48%), which may imply that they are older adults who were married at one point in time. This figure was followed by 27.59% for single people, 20.69% for married managers, and 17.24% for divorced managers. This contrasts with the results obtained from Modiba (2009), who claim that most of the people who participate in agriculture are married and not widows. The results indicated that 41.38% of the managers were once farm workers, 20.69% previously worked as supervisors, 13.79% of the managers were self-employed and working class, whereas 10.34 were in middle management before they could be managers of the cooperatives. This implies that most of the managers had prior experience in farming before they could be managers of cooperatives. The results from Table 2 showing the demographics of the crop cooperative managers show that the majority (48.28%) of the managers have completed primary school grades, and this should be a major concern that most of the people who are managing cooperatives do not necessarily have the necessary skills and academic knowledge. The majority is followed by those with Post grade 12 certificates, those who completed high school, and those with a university degree at 17.24%. This is in line with Gotyi (2019), where the author asserts that cooperative education and

training are not taken seriously in South Africa, and there's only one University that offers a 3-year formal qualification in cooperative management, which is the University of KwaZulu-Natal (UKZN). This explains why most of the cooperative managers have the highest qualifications, which are lower than Post grade 12 certificates. The results from Table 2 show that most cooperative managers (82.76%) are not entrepreneurial alert, while 17.24% are alert.

4.2. Entrepreneurship Skills of Agricultural Cooperative Managers

The results of the study, as illustrated in the table below, showed that 58.6 % of the respondents highlighted that they are slightly skilled with Opportunity and Strategic skills, 44.8% maintained that they are moderately skilled with Management and Networking skills. Moreover, only 17.2% of the managers believed they were very Professionally skilled. Overall, Table 3 shows that most managers possess moderate entrepreneurship skills. According to McElwee (2006), these results show that most managers cannot recognise problems before they arise because they lack skills such as opportunity and strategic skills, which can help them solve problems they are faced with. Therefore, farmers under such cooperatives may face difficult challenges because of this insufficiency. Rudmann *et al*. (2008) suggest that farmers mostly need professional skills for their success, one of the skills most cooperative managers lack based on the above results.

TABLE 3: Entrepreneurship Skills of Cooperative Managers

Entrepreneurship skills										
	Professional		**Management**		**Opportunity**		**Strategic**		**Networking**	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Not at all	0	0	5	17.2	7	24.1	11	37.9	10	34.5
Slightly		10.4	13	44.8	17	58.6	17	58.6	14	48.3
Moderately		37.9	5	17.2	3	10.3	1	3.4	3	10.3
Skilled		34.5	6	20.7	2	6.9	0	0	2	6.9
Very		17.2	0	0	0	0	0	0	0	0
Total	**29**	**100**	**29**	**100**	**29**	**100**	**29**	**100**	**29**	**100**

4.3. Cooperative Performance

4.3.1. Level of Productivity

The study used technical efficiency to measure primary agricultural cooperatives' productive efficiency (productivity). Technical efficiency is the farm's ability to maximise output using a

given set of resource inputs (Chirwa, 2007). The stochastic frontier approach was adopted to measure productive efficiency in these cooperatives. The results are presented below.

TABLE 4: Stochastic Frontier Regression Model Results

Number of observation = 29
Wald chi2 (2) = 11.74
Prob > chi = 0.0028

CTFERT	Coef.	Std. Err	z	P>l z l	[95% Conf.	Interval]
CTHERB	.7897741	.2549977	3.10	0.002*	.2899877	1.289561
CTSEED	-.1400162	.1180896	-1.19	0.236	-.3714677	.0914352
_cons	7.028553	2.097747	3.35	0.001	2.917044	11.14006
/lnsig2v	-.4936692	.2631091	-1.88	0.061	-1.009354	.0220152
/lnsig2u	-9.203449	267.5857	-0.03	0.973	-533.6617	515.2548

LR test of sigma_u=0: chibar (01) = 0 Prob >= chibar2 = 1.000

F-statistic p-value 0.0121

VIF mean 1.01

Adjusted R-squared 0.2334

***, **, * significant at 1%, 5% and 10% respectively

CTFERT= Crop Ton Fertilizer, CTHERB= Crop ton Herbicides, CTSEED= Crop ton Seeds (Frontier variables)

Table 4 above shows the stochastic frontier regression model's results as outlined in the previous chapter. The analysis aimed to assess the current level of productivity of primary agricultural crop cooperatives in Ngaka Modiri Molema District. The goodness-of-fit of the estimated model was measured using F-statistic, and the results show an F-statistic p-value of 0.0121, which indicates an acceptable measure of fit. Moreover, multicollinearity was tested, and the results showed an average Variance Inflation Factor of 1.01, which is lower than 8, showing no multicollinearity in the analysis. The Breusch-pagan/Cook-Weisberg test was also performed to check heteroscedasticity. The results showed that heteroscedasticity was 0.6375, which is higher than 0.05. Therefore, this asserts that there was no heteroscedasticity.

4.3.2. Technical Efficiency Estimates

According to Ali and Byerlee (1991), a farmer is technically inefficient in increasing farm output without increasing the use of at least one input is impossible. Moreover, factors like improper timing or method of input application such as fertilisers, which in most cases is caused by lack of information, can cause technical inefficiency. Given the specification of the stochastic frontier model in equation (1), the results in Table 5 of the predicted technical efficiency vary slightly among cooperatives, with a minimum value of 0.9920, a maximum value of 0.9922, and a mean efficiency of 0.9920437. Table 5 shows the frequency distribution of technical efficiency estimates of the sampled crop cooperatives.

TABLE 5: Frequency Distribution of Technical Efficiency Estimates of the Cooperatives

Figure	Frequency	Percent	Cum.
0.90 – 1.00	29	100.00	100.00
Total	**29**	**100.00**	

Source: Results obtained from STATA (version 15) generated from telephone survey, 2021, 2022

According to the results in Table 5, the distribution of the technical efficiency shows that 100% of the sampled cooperative's technical efficiency skewed in the 0.90-1.00 range. This indicates that most cooperatives use their advanced technological resources efficiently in the production process.

4.3.4. Financial Performance

The study employed the Data Envelope Analysis Program (DEAP) to analyse the financial performance of the primary agricultural crop cooperative in Ngaka Modiri Molema District of the North West Province. This computer program is used to conduct Data Envelopment Analysis (DEA) using financial ratios to calculate efficiencies in production. This study used Malmquist DEA methods to calculate catalogues of Total Factor Productivity (TFP) change, technical efficiency change, and scale efficiency change. Table 6 below shows the results of the Malmquist method of the DEA.

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TABLE 6: Malmquist Index Summary

	Year 1					Year 2				
Cooperative	**effch**	**techch**	**Pech**	**sech**	**tfpch**	**effch**	**techch**	**pech**	**sech**	**tfpch**
1	0.755	0.684	0.104	7.250	0.517	0.417	1.808	0.417	1.000	0.755
2	7.706	0.334	14.500	0.531	2.574	0.257	2.336	1.000	0.257	0.601
3	2.900	0.686	2.900	1.000	1.990	0.381	1.213	0.381	1.000	0.462
4	5.750	0.150	5.750	1.000	0.860	0.174	5.913	0.174	1.000	1.028
5	0.972	0.636	0.972	1.000	0.618	1.029	0.769	1.029	1.000	0.791
6	1.000	2.425	1.000	1.000	2.425	1.000	0.723	1.000	1.000	0.723
7	1.000	0.529	1.000	1.000	0.529	2.154	0.952	4.000	0.538	2.051
8	1.014	0.632	1.014	1.000	0.641	0.998	0.677	0.998	1.000	0.676
9	1.000	0.611	1.000	1.000	0.611	1.000	0.667	1.000	1.000	0.667
10	2.900	1.003	2.900	1.000	2.907	0.435	1.950	0.435	1.000	0.848
11	1.000	0.500	1.000	1.000	0.500	1.000	0.667	1.000	1.000	0.667
12	1.481	1.082	1.000	1.481	1.602	0.477	0.917	0.477	1.000	0.437
13	0.893	0.554	0.893	1.000	0.495	1.000	0.667	1.000	1.000	0.667
14	0.905	2.549	0.560	1.616	2.307	1.786	0.467	1.786	1.000	0.833
15	1.216	0.544	1.216	1.000	0.661	0.968	0.994	0.968	1.000	0.962
16	0.963	0.566	0.963	1.000	0.545	1.058	0.680	1.058	1.000	0.719
17	1.000	0.500	1.000	1.000	0.500	1.000	0.667	1.000	1.000	0.667
18	1.068	1.484	1.068	1.000	1.585	0.944	0.552	0.944	1.000	0.521
19	1.058	0.635	1.058	1.000	0.672	0.934	0.950	0.934	1.000	0.887
20	1.157	1.315	1.157	1.000	1.521	0.932	1.092	0.932	1.000	1.018
21	1.314	0.635	1.362	0.964	0.834	0.761	1.018	0.734	1.037	0.775
22	1.053	0.608	1.053	1.000	0.640	1.198	1.403	1.198	1.000	1.680
23	1.000	0.286	1.000	1.000	0.286	1.000	2.601	1.000	1.000	2.601
24	1.060	2.355	1.060	1.000	2.497	1.000	0.723	1.000	1.000	0.723
25	1.000	2.425	1.000	1.000	2.425	1.000	0.723	1.000	1.000	0.723
26	1.000	0.611	1.000	1.000	0.611	1.077	0.943	1.077	1.000	1.016
27	1.000	0.611	1.000	1.000	0.611	1.022	0.661	1.022	1.000	0.676
28	1.000	0.611	1.000	1.000	0.611	1.000	0.667	1.000	1.000	0.667
29	1.000	0.570	1.000	1.000	0.570	1.000	1.491	1.000	1.000	1.491
Mean	1.256	0.725	1.165	1.078	0.911	0.832	0.994	0.890	0.935	0.827

KEY CODES:

effch– efficiency change

techch– technical efficiency change

pech–pure efficiency change

sech–scale efficiency change

tfpch–total factor productivity change

The above Table 7 indicates that for 2018/19, the average total factor productivity change is 8.9%, signifying a decline in total productivity from 2017/18 due to efficiency change. The results further assert that cooperative number 10 had the highest total factor productivity change amongst the 29 cooperatives in the study area during year 2 at 90.7%. This increase was due to the rise in the efficiency change to the extent of 90% and pure efficiency change to the extent of 90%, while the scale efficiency change remained constant. During the year 2018/19, 65.52% of the cooperatives experienced a decline in total factor productivity change, and a cooperative that had the lowest total factor productivity change was cooperative number 13, which experienced a total decline of 50.5%. For the year 2019/20, the average total factor productivity change was 17.3%, which was less than the year 2018/19.

Furthermore, this average total productivity change of 17.3% of the year 2019/20 shows that there has been a decline in the productivity of cooperatives in that year, and this decline was mainly due to technical efficiency changes within cooperatives. This means that most of the cooperatives were not growing, and the technical efficiency of some was high, which meant that they used most of their advanced technologies. Moreover, 21 out of 29 cooperatives had a decline in the total factor productivity change during 2019/20, which is 72% of the cooperatives. In the case of cooperative number 10, which was doing great in the year 2018/19, in the year 2019/20, it faced a decline in total factor productivity change of 15.2%. This suggests that even cooperatives doing well in 2018/19 are now struggling financially.

4.4. Malmquist Index Summary of Annual Means

TABLE 7: Malmquist Index Summary of Annual Means

Year	effch	techch	Pech	sech	tfpch	***KEY CODES:***
2	1.256	0.725	1.165	1.078	0.911	**effch**– efficiency change
3	0.832	0.994	0.890	0.935	0.827	**techch**–technical efficiency change
Mean	1.023	0.849	1.018	1.004	0.868	**pech**–pure efficiency change
						sech–scale efficiency change
						tfpch–total factor productivity change

Table 7 above shows the malmquist index summary of annual means for sampled primary agricultural crop cooperatives. For the entire study period, the average total factor productivity change experienced a decline of 13.2%. This decline was due to a decrease in the technical

change of cooperatives to an extent of 15.1%, although there was an increase in scale efficiency to the extent of 0.4% and pure efficiency by the value of 1.8%. From 2018/19 to 2019/20, the total factor productivity change declined by 0.084 units.

4.5. Malmquist Index Summary of Firm Means

TABLE 8: Malmquist Index Summary of Firm Means

Cooperative	effch	Techch	pech	sech	tfpch
1	0.561	1.112	0.209	2.693	0.624
2	1.408	0.883	3.808	0.370	1.243
3	1.051	0.913	1.051	1.000	0.959
4	1.000	0.940	1.000	1.000	0.940
5	1.000	0.699	1.000	1.000	0.699
6	1.000	1.324	1.000	1.000	1.324
7	1.468	0.710	2.000	0.734	1.042
8	1.006	0.654	1.006	1.000	0.658
9	1.000	0.638	1.000	1.000	0.638
10	1.123	1.398	1.123	1.000	1.570
11	1.000	0.577	1.000	1.000	0.577
12	0.840	0.996	0.690	1.217	0.837
13	0.945	0.608	0.945	1.000	0.574
14	1.271	1.091	1.000	1.271	1.386
15	1.085	0.735	1.085	1.000	0.798
16	1.009	0.620	1.009	1.000	0.626
17	1.000	0.577	1.000	1.000	0.577
18	1.004	0.905	1.004	1.000	0.909
19	0.994	0.777	0.994	1.000	0.772
20	1.038	1.198	1.038	1.000	1.244
21	1.000	0.804	1.000	1.000	0.804
22	1.123	0.924	1.123	1.000	1.037
23	1.000	0.862	1.000	1.000	0.862
24	1.030	1.305	1.030	1.000	1.344
25	1.000	1.324	1.000	1.000	1.324
26	1.038	0.759	1.038	1.000	0.788
27	1.011	0.636	1.011	1.000	0.643

KEY CODES:

effch– efficiency change

techch–technical efficiency change

pech–pure efficiency change

sech–scale efficiency change

tfpch–total factor productivity change

28	1.000	0.638	1.000	1.000	0.638	
29	1.000	0.922	1.000	1.000	0.922	
Mean	1.023	0.849	1.018	1.004	0.868	

The results in Table 8 illustrate that cooperative number 10 was more efficient in the study period than other cooperatives because it had the highest total factor productivity change of 57%. This was due to an increase in pure efficiency change to an extent of 1.8% and an increase in scale efficiency by 0.4%. This cooperative was followed by a cooperative number with a total factor productivity change of 38.6%, and this increase was due to scale efficiency change by 27.1% and technical change by an extent of 9.1%, although pure efficiency remained stagnant.

4.5.1. Canonical Analysis

This study used canonical correlation analysis to measure the relationship between two variables cooperative performance (Financial performance and Productivity) and Entrepreneurship skills (Professional skills, Management skills, Opportunity skills, Strategic skills, and Networking skills). A canonical analysis is used to show how much variance of the dependent variables is explained by the dimensions. Furthermore, the study employed Wilk's Lamda and corresponding *F*-test to evaluate the study's null hypothesis, which stated that the canonical correlations for all functions are zero. Only one of the two canonical correlation coefficients for this model is statistically significant, $p<0.05$. The other function is not statistically significant and will not be interpreted.

The CCA coefficient reflects the strength of the relationship between the pair of variates (R_c). For the first function, R_c = 0.5883. For the second function, R_c= 0.4631. The canonical correlation, when squared, shows how much variance in one canonical variate with ideal weights is explained by the other canonical variate with optimal weights.

A measure of redundancy is the variance of one set of variables as anticipated from the other set of variables when they are combined linearly. Like the squared multiple R in multiple regression R_d. Remember that the squared. R_c must also be exactly equal to 1 for the redundancy coefficient to be equal to 1 and the synthetic variables for the function to accurately represent all the variance of each variable in the set. The canonical correlation's meaning may be tested using the redundancy index. For the first function R_d= 0.1741 for the *u*-variables, and

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R_d= 0.0791 for the *v*-variables. For the second function, R_d= 0.1066 for the *u*-variables, and R_d= 0.0584 for the *v*-variables.

Canonical loadings and standardised canonical coefficients were used to assess the relative weights of the model's variables. Table 9 below shows the significant (first) function's normalised canonical coefficients. For the first variable set, *productivity* is most important; a one standard deviation increase in *productivity* leads to a 0.7581 increase in the score on the first canonical variate in the second variable set when the other variable in the model is held constant. For the second variable set, *networking skills* are most important; a one standard deviation increase in *networking skills* leads to a 0.7971 increase in the score on the second canonical variate in the first variable set when the other variables in the model are held constant. Financial performance favourably contributes to the canonical connection, as shown by the data in Table 9. Only one variable in the first dependent variate has a loading equal to or greater than 0.59, indicating a high degree of correlation between the two variables and indicating that the financial performance measure is the only reliable indicator of the cooperative level performance of crop cooperatives. However, ranking the average proportion of canonical loading shows that the only reliable indication of farm-level performance is financial performance.

Except for one negative loading, the independent variates in function one all show positive loadings between 0.2671 and 0.7971. It is not surprising that the three variables with the highest loading are "Management skills" (0.5152) and "Networking skills" (0.7971), which are the variables that contribute most to cooperative performance since the extraction of the variates in canonical correlation to maximise the predictive objectives. Opportunity skills, however, also account for a sizeable portion of the observed range in cooperative performance (0.2671).

Moving on to Function 2, the coefficients in Table 9 show a very different pattern, with "Management skills" being the factor that most significantly influences the canonical connection (0.7737). Both "Strategic skills" and "Networking skills" have negative coefficients in this function.

TABLE 9: Standardised Coefficients

Standardised coefficient for the first variable set

	1	2
Productivity	0.7581	0.6522
Financial performance	-0.6475	0.7621

Standardised coefficient for the second variable set

	1	2
Management skills	0.5152	0.7737
Opportunity skills	0.2671	0.0589
Strategic skills	-0.4153	-0.2580
Networking skills	0.7971	-0.6271

Canonical loadings are illustrated in Figure 4.10 for the *u*-variables; *productivity* is most closely related to the first canonical function, and *financial performance* is most closely associated with the second canonical function. For the *v*-variables, *networking skills* are most closely related to the first canonical function, and *management skills* are most closely associated with the second canonical function.

TABLE 10: Canonical Loadings

Canonical loadings for variable list 1

	1	2
Productivity	0.7621	0.6475
Financial performance	-0.6522	0.7581

Canonical loadings for variable list 2

	1	2
Management skills	0.5228	0.7406
Opportunity skills	0.1011	0.3811
Strategic skills	-0.2448	-0.0415
Networking skills	0.7552	-0.6280

Heenkenda and Chandrakumara's (2016) interpretation was adopted in this study. The canonical correlation demonstrates the extent to which the dimensions account for the variance of the dependent variables. The overall multivariate significance tests are displayed in Table 10. In Panel A and Panel B of Table 10, the latent successive root tests, eigenvalues, and canonical correlation coefficients obtained from the study are displayed. The canonical correlations demonstrate the extent to which the dimensions account for the variation of the dependent variables. Only the first of the two canonical dimensions this model shows is statistically significant. The first test of dimensions, which examined the significance of each dimension individually and together, concluded that it was significant. It was also significant in the second test of dimensions, which looked at whether dimensions 1 and 2 taken together were significant. The final test of dimensions, which examined the significance of the combination of dimensions 2 and 2, did not find any significance.

Canonical correlation measures the percentage of variance the predictor canonical variate explains in the dependent canonical variate. The result shows a significant function ($p < .005$) and provides the proportion of total variability that is not explained. The null hypothesis that the provided canonical correlation and any smaller ones are equal to zero in the population is tested using the Wilks lambda test statistic. Each value can be calculated as the sum of 'cooperative performance' for the set of canonical correlations being investigated. According to the results of this analysis, the canonical correlations are 0.5883 and 0.4631; therefore, the value for testing both correlations are zero (1- 0. 5883)*(1-0. 4631) * = 0.51369.

TABLE 10: Multivariate Tests and Canonical Analysis

Multivariate Tests of significance (S=2, M=O, N=29					**Panel A**
Test Name	Value	Approximate F	Hypothesis DF	Error DF	Significance of F
Pillais's	0.56053	2.3364	8	48	0.0331
Hotellings's	0.802214	2.2061	8	44	0.0453
Wilks's	0.51369	2.2726	8	46	0.0386
Roys's	0.529176	3.1751	4	24	0.0315
Eigenvalues and Canonical Correlations					**Panel B**

Root No.	*Eigenvalue*	*%*	*Cumulative %*	*Canonical correlation*	*Squared Correlation*
1	0.6980	49.3600	49.3600	0.5883	0.3461
2	0.7161	50.6400	100.000000	0.4631	0.2145
Dimension Reduction Analysis					**Panel C**
Roots	*Wilks λ*	*F*	*Hypothesis DF*	*Error DF*	*Significance of F*
1 TO 2	0.51369	2.2726	8	46	0.0386
2 TO 2	0.785523	2.1843	3	24	0.1161

The canonical correlations are shown in Figure 1 for a simple understanding of the findings. It demonstrates that for root 1 and root 2, respectively, the correlations between the two sets of variables are 0.5883 and 0.4631. Given a significant link between "cooperative performance" and "entrepreneurship skills," these show statistically significant correlations between the two variables. When all dimensions (roots) are considered, two sets of variables exhibit a strong link; however, when the dimensions are reduced from 2 to 1, the association steadily deteriorates from 0.5883 to 0.4631.

Important economic insights can be gained by interpreting the correlations (factor loadings) between the dependent and canonical variables, reflecting latent components. Regarding Root 1 of 2, the factor loadings of “Management skills, Opportunity skills, Strategic skills, Networking skills” are 0.52, 0.27, -0.42, and 0.80, respectively. On the other hand, the left side of the figure's factor loadings shows how much of the variance in the dependent variables may be attributed to the latent, independent factors. It demonstrates that "Financial performance" and "Productivity" have factor loadings of 0.7581 and -0.6475, respectively. The factor loadings for "management skills," "opportunity skills," "strategic skills," and "networking skills" are 0.78, 0.06, -0.26, and -0.63, respectively, for Root 2 of 2. However, factor loadings for "Financial performance" and "Productivity" are 0.6522 and 0.7621, respectively, as seen on the left-hand side of the figure.

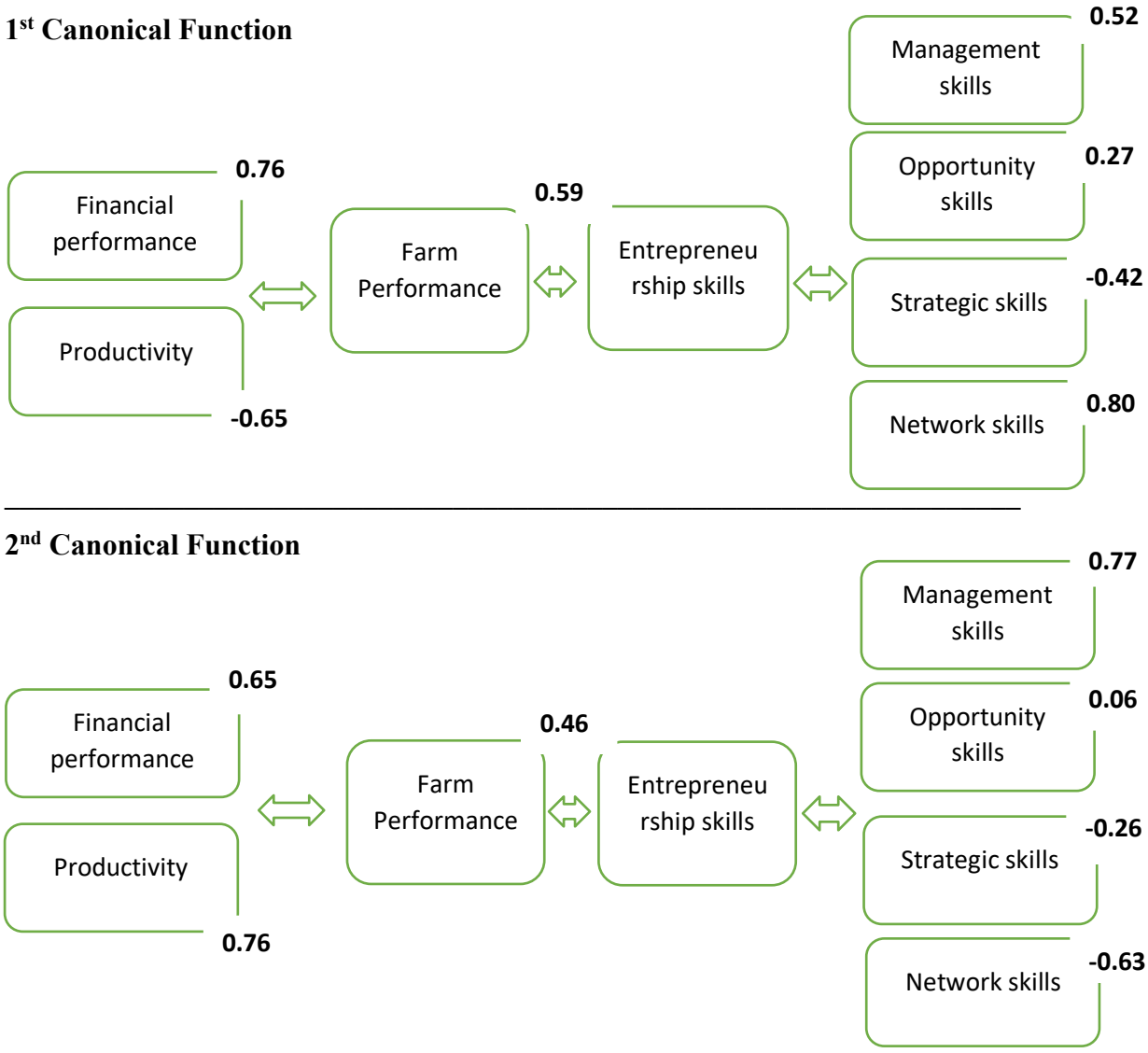

FIGURE 1: Canonical Correlation

To assess the shared multivariate relationship between the two sets of variables, the canonical correlation analysis was performed utilising two farm-level performance characteristics as predictors of the four entrepreneurship skills variables. The analysis produced two functions for each succeeding function with squared canonical correlations (Rc2) of 0.3461 and 0.2145. Using the Wilks' = 0.51369 criteria, F (8, 46) = 2.2726, p.005, the whole model for all functions was statistically significant. Wilks denotes the variance that the model cannot account for, and 1 denotes the whole model effect size in an r2 metric.

The hierarchical arrangement of functions was tested for statistical significance using the dimension reduction analysis that the analysis produced. At F (3, 24) = 2.1843, p>0.005, function 2 to 2 was not statistically significant.

5. PROPOSED ENTREPRENEURSHIP FRAMEWORK

The purpose of the study was to examine whether a relationship exists between the entrepreneurship skills of agricultural primary crop cooperative managers and the level of cooperative performance. The study recognised that management skills, opportunity skills, and networking skills are significantly associated with the cooperative performance factors (Financial performance and productivity) as shown in Figure 2 below. It also identified that financial performance was the main contributor to the performance of the crop cooperatives.

The relationship between the variables demonstrates that management and opportunity skills are important policy variables that can improve the cooperatives' financial performance and productivity. The analysis in Figure 2 above indicates that the relationship between management skills, opportunity skills, and cooperative financial performance is the one that is strongest among the relationships that have been identified. As a result, it can be recommended that cooperative managers be strengthened with these skills to direct practically all economic performance indicators positively. Figure 2 below illustrates the entrepreneurship framework that is proposed by the study.

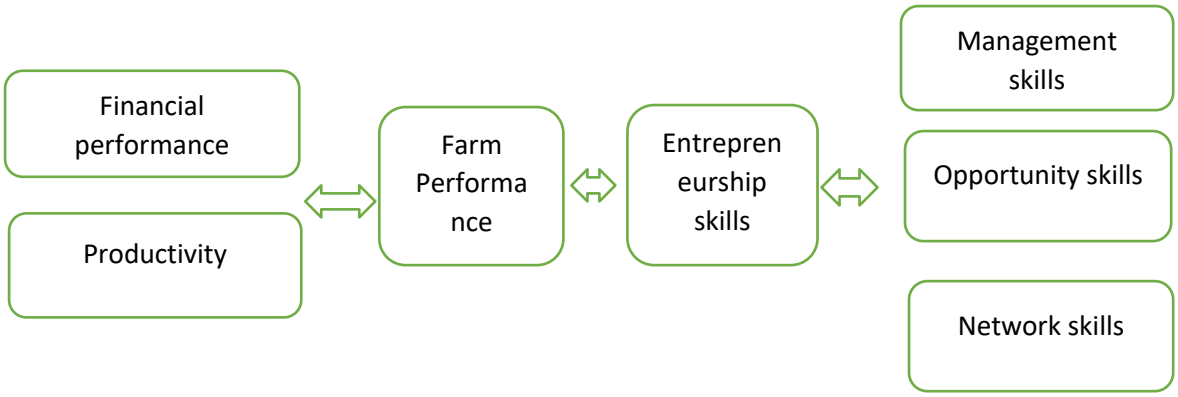

FIGURE 2: Proposed Entrepreneurship Framework

6. CONCLUSION AND RECOMMENDATIONS

The empirical part of the study involved exploring the relationship between the entrepreneurship skills of cooperative managers and cooperative performance, which led to the formulation of the entrepreneurship framework to improve the performances of primary crop

cooperatives. However, according to the results, the association between variables shows that management and opportunity skills are significant policy variables that can raise the financial performance and productivity in agricultural crop cooperatives.

Based on the results of this study, recommendations can be drawn to improve the performance of primary agricultural crop cooperatives in Ngaka Modiri Molema District. The results obtained suggest that to improve the performance of those agricultural crop cooperatives, cooperative managers should be equipped with entrepreneurial skills and be entrepreneurially alert. The results suggest that cooperative managers need support programs where they will be equipped with such skills. Despite the numerous debates about cooperative failures in developing countries, the study's findings confirm that entrepreneurship remains the solution to most of the problems faced by smallholder farmers and primary cooperatives. According to the study, cooperative membership improves the welfare of participating farmers. The findings imply that both parties must be entrepreneurial to improve the performance of smallholder farmers and cooperative managers. Furthermore, the result of this study suggests that management skills, opportunity skills, and networking skills are significantly associated with the cooperative performance factors (Financial performance and productivity). The association between variables shows that management and opportunity skills are significant policy variables that can raise agricultural crop cooperatives' financial performance and productivity.

The development of an entrepreneurship framework to improve the performance of primary agricultural cooperatives was only done in Ngaka Molema District. Therefore, it is suggested that such studies, which may be more or less similar to this, be conducted in North West province as a whole. Furthermore, the focus of this study was on primary agricultural crop cooperatives. Therefore, it is suggested that further studies be done on all North West cooperatives to improve their performances.

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Perception and Utilisation of Organic Farming Practices among Smallholder Farmers: Evidence from a Micro-Level Survey in Ehlanzeni District South Africa

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ABSTRACT

The study analysed the perception of organic farming practices among smallholder farmers in Mbombela, Mpumalanga, South Africa. An interview-administered questionnaire collected data from 80 randomly sampled smallholder farmers. The elicited data was descriptively analysed using percentages, averages, and ranks. In contrast, a multiple linear regression model was used to determine the socioeconomic factors that influence smallholder farmers' utilisation of organic farming practices. The findings revealed that although smallholder farmers were aware of organic agricultural methods, adopting organic practices is still yet to be widespread and optimal in the area. This is due to some severe challenges indicated by the respondents, including inadequate government support, the unpredictability of climate change, inadequate access to grants and credit facilities, inadequate collaboration and collective action among farmers, and inadequate access to extension services. Furthermore, the findings of the regression model revealed that formal education and organic farming training attendance were significant socioeconomic factors influencing smallholder farmer's utilisation of organic farming practices. Given the need to scale up the adoption of organic farming practices in the area, it was recommended that increased government support, adequate access to credit facilities and significant improvement and effectiveness of extension services in providing training and encouraging collective action among the smallholder farmers is required.

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Keywords: Smallholder farmers, Perception, Utilisation, Organic Farming

1. INTRODUCTION

Agriculture remains one of the most important sectors of the economy in many developing countries due to its overall contribution to the Gross Domestic Product and employment for most rural dwellers (Manida & Nedumaran, 2020). Smallholder agriculture in South Africa is perceived as a livelihood option to achieve poverty reduction and rural development goals (Ncube, 2017). Smallholder farmers' contribution to ensuring food security for the teeming world population is increasingly recognised as the global population is expected to reach 9.5 billion people by 2050 (Uhunamure *et al.,* 2021). Therefore, the rapidly expanding world's populace has increased the use of technology, machineries and chemical inputs, generating several health and environmental concerns (Udeigwe *et al.,* 2015). This has led to the increasing call for all categories of farmers, both commercial and smallholders, to use more efficient agricultural practices, one of which is the applicability of organic farming practices.

From the 1920s to the 1950s, the original idea of organic agriculture was advocated as a critique of the newly developing industrial food system (Seufert *et al.,* 2017). According to Ahuja *et al.* (2020), organic farming practices generally involve biological, cultural, and mechanical practices to promote the cycling of on-farm resources, maintain ecological balance, and conserve biodiversity. Organic farming is the best way to mitigate the adverse effects of chemical farming practices (Meemken, 2018). It is aimed at environmentally friendly production by avoiding the use of synthetic fertilisers and pesticides and by a firm reliance on closed on-farm nutrient cycling, including biological nitrogen fixation and crop rotations, to support soil fertility by enhancing soil organic matter content (Leifeld, 2012; Janjhua *et al.,* 2019). However, despite the advantages and prospects of organic farming practices, smallholder farmers face significant hurdles when attempting to transition to organic farming (Jouzi *et al.,* 2017). The adoption of organic farming practices, especially among smallholder farmers, is associated with a lot of factors, which might include costs, farmers' innovation-averseness, access to appropriate training, access to relevant advisory services, government policies and availability of market outlets (Uhunamure *et al.,* 2021). Smallholder farmers may hesitate to use new techniques, fearing a decreased yield if they use organic farming practices. Others are concerned about losing their profits since they rely on them

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for survival (Ullah *et al.,* 2015). Thus, the need to promote the adoption of organic farming practices was recognised to potentially assist in mitigating some of the environmental impact and soil quality challenges without compromising food security and farm revenues.

Several previous documented research studies have focused on Recycling Agricultural Wastes and By-products (Diacono *et al.,* 2019), conservation tillage and organic farming (Seitz *et al.,* 2019), comparison between conventional and organic farming systems (Le Campion *et al.,* 2019). Moreover, similar perception-related studies regarding converting to organic farming (Bouttes *et al.,* 2018) found that transition to organic farming is a way to enhance their adaptive capacity in four ways: increasing professional satisfaction, stimulating learning, reducing risks, and enabling to maintain a family. However, scant empirical research, especially in the Mpumalanga province, has focused on the perception and extent of the utilisation of organic farming among smallholder farmers. Therefore, to fill this lacuna, the study attempted to proffer insight into the disposition of smallholder farmers to organic farming and the level of use so far. This will provide empirical information for governments, policymakers, extension advisory services and other relevant stakeholders on how to strategise and improve the application of organic farming practices in the area by providing solutions to the contextual factors peculiar to smallholder farmers. Furthermore, the study aligns with the Sustainable Development Goals (SDG 1, 2, 3 and 12) to end all forms of poverty and hunger, promoting good health and well-being by ensuring responsible consumption and production by 2030. Therefore, the study will pave the way for strategies and gaps that need to be filled in creating the right platforms to ensure effective service delivery by agricultural extension services.

To achieve the aim of the study, four research objectives guided the study: determine the perception of the smallholder farmer on organic farming practices, examine the degree of utilisation of organic farming implementation among smallholder farmers in the area, investigate the barriers that prevented the application of organic farming practices among the smallholder farmers, and determined the socioeconomic factors influencing the utilisation of organic farming practices.

2. METHODOLOGY

2.1. Study Area

The study was conducted in Mbombela (Nelspruit), which is a town in the Mpumalanga province of South Africa that is part of the Mbombela Local Municipality with a Latitude of -25.475298 and Longitude of 30.969416 (Hughes, 2018). Nelspruit has a sub–tropical climate, with an average annual precipitation of 764 mm, more than 85 percent of which falls during the summer (Murovhi & Materechera, 2015). Nelspruit, which literally means "Nels Stream," is located in the heart of the Lowveld on the banks of the Crocodile River (Rowe, 2020). The area's topography is relatively flat and has been used for agricultural purposes in the olden days and currently (Pelser, 2019). The place attracted high-profile traders and farmers due to the massive pure quality of the soil, sufficient irrigation water, and a smooth valley floor (Rowe, 2020). Nelspruit has become one of the biggest sources of tobacco, litchis, mangoes, avocados, and other fruits and vegetables (Rowe, 2020).

2.2. Sampling Procedure and Sampling Size

Quantitative research was adopted in the study using a descriptive survey research design. The research design was employed following the lead of Olorunfemi (2018) and Omotayo *et al.* (2021), who also applied this design in a similar perception-related study. Based on the information from the Department of Agriculture, Rural Development, Land, and Environmental Affairs, the sample size used in the study numbered 80 smallholder farmers drawn from 1594 smallholder farmers (DARDLEA, 2022). Therefore, because of time and resource constraints, simple random sampling was used to select 5% of the smallholder crop farmers from the population.

2.3. Data Collection and Analysis

A structured questionnaire was developed as the survey instrument to elicit data for the study. The collected data was then analysed using descriptive statistics such as frequency counts, percentages, means and ranks using IBM SPSS version 28. Furthermore, multiple linear regression adopting the ordinary least square approach was used as an inferential statistic to analyse the socioeconomic factors influencing smallholder farmers' utilisation of organic farming practices in the area. The respondents' socioeconomic characteristics were the independent and explanatory variables used

in the regression model, while the computed smallholder perception on the effects of organic farming practices score of the respondents served as the dependent variable in the model.

2.4. Model Specification

2.4.1. Inferential Statistics

The multiple linear regression model was employed in the study due to its ability to use several independent or explanatory variables to determine the outcome of dependent variables that are continuously measured (Ijatuyi *et al.,* 2022). The model was used to analyse the respondents' socioeconomic characteristics that significantly influence their utilisation of organic farming practices. Data concerning the respondents' perceptions on the effects of organic farming practices was assessed in terms of a five-point Likert Perception Scale rated as strongly disagree (1), disagree (2), undecided, agree (4), and strongly agree (5). Following the lead of Nyawo and Olorunfemi (2023), a composite score analysis was then used to compute individual utilisation scores for each respondent from the Likert scales. This computed utilisation index then served as a proxy for the farmers' utilisation, which was then fitted as the dependent variable in the multiple linear regression model.

The explicit form of the model can thus be given as:

$Y=\beta_0+ \beta_1X_1+ \beta_2X_2 \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ BnXn + e$

Where:

Y is the farmer's utilisation score/index on organic farming practices.

X is a vector of hypothesised explanatory variables which included farmers' socioeconomic characteristics (age, gender, marital status, educational attainment, household size, farming experience and so on).

β is a vector of unknown parameters to be estimated and ϵ is independently and normally distributed random error term.

3. RESULTS AND DISCUSSION

3.1. Socioeconomic Characteristics of the Smallholder Farmers

The results in Table 1 showed that the majority (78.75%) of smallholder farmers were between the ages of 26 and 50, 11,25% were above the age of 51, and just a few (10.0%) were under the age

of 25 years. The smallholder farmers' average age of 35.70 years implies they are still in their youthful and productive years. This agrees with Ofuoku and Ekorhi-Robinson (2018), who postulated that younger farmers have sufficient energy for farming. The results also indicate an equal number of men (50.0%) and women (50.0%) participating in the area. This implies that both sexes have equal potential and can participate in agricultural enterprises successfully. This aligns with the government mandate for all agencies' budgets and policies to reflect gender equality (Lee, 2021). Additionally, the marital status shows that most respondents (70%) were unmarried, while 30% were married. This implies that the majority of the farmers do not have marital relationship ties and are more disposed to be able to make individual farm decisions without having to consult with their partners. Thus, single farmers are more likely than married farmers to engage in and adopt agricultural techniques.

Furthermore, Table 1 reveals that the overall mean household size in the study area was seven persons, with a standard deviation of 4 persons, and that more than half (53.75%) of smallholder farmers had families of 6–10 members, 32.6% had families of less than five members, and 13.75% had families of 11 members or more. An average household size of 7 persons indicates that smallholder farmers have dependents and responsibilities at home, and it is more likely that people rely on them. Kolleh (2016) opined that a large household size offers farmers greater access to family labour, which is expected to reduce farm costs and enhance maximum output.

The results in Table 1 also reveal that the majority of the smallholder farmers (81.25%) had farming experience of less than a decade (10) years, 15% had farming experience from 11 - 20 years, while a few 3.75% had farming experience of more than 21 years. The average mean farming experience of 7.48 years suggests that most farmers are still within their first decade of farming experience. Despite most farmers having minimal farming experience, further interaction with them during the data collection process demonstrated that they generally have a positive attitude toward engaging in agricultural activities. They also indicated their willingness to learn more and build on what they already knew to increase their intelligence level. Atube *et al.* (2021) state that the likelihood of using better farming methods, such as organic farm practices, rises with increased farming experience. This might be because experienced farmers have a plethora of local knowledge and information about the most effective agricultural strategies to apply.

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Furthermore, Table 1 shows the results that more than half (53,75%) of smallholder farmers had farm size of less than 5 hectares, 31.25% had farm size of 6 -10 hectares, and a few (15.0%) of farmers had farm size of 11 and more hectares of land. The average overall mean farm size of 6.68 hectares indicates that the farmers in the area have pretty sizeable areas of farmland that they use for agricultural purposes, which, if properly managed, could contribute to sustainable and improved farmer livelihoods. Nnadozie *et al.* (2015) and Anigbogu *et al.* (2015) stated that the relationship between farm size and output implies that the size of the farm holding affects output; that is, the smaller the size of the farm, the smaller the production and invariably the farm income. Also, Oluwatayo (2019) stated that increased farm size increases farmers' likelihood of using innovative practical techniques and increasing yields.

Moreover, the results in Table 1 show that under two-thirds (62.5%) of smallholder farmers had formal education ranging from one to twelve years, with just a few (3.75%) having no formal education. The mean years of formal education in the area was 9 years, implying that the farmers have some level of exposure and knowledge that can enhance their use of organic farming practices. Simotwo *et al.* (2018) concurred and revealed that the respondents' access to education varied with their ages, with younger people having more education than older people. These circumstances could impact how quickly new farming technologies are adopted.

The results in Table 1 show that extension officers visited the majority (71,13%) of smallholder farmers to assist them with information on how to improve their cultivation. This suggests that most farmers will be exposed to information on innovative strategies, such as organic agricultural farming practices in the area. Furthermore, Table 1 also shows that the majority (95,0%) of smallholder farmers were already engaged in organic farming practices. This might be attributed to most farmers' exposure to agricultural extension services. However, just a few (5.0%) were not yet engaged in any form of organic farming practices, probably because they still lack information, as some farmers mentioned during the survey that they do not know much about organic farming practices.

Moreover, Table 1 shows that the majority (70.0%) of smallholder farmers have been exposed to one form of organic farming training, which also buttresses previous findings and provides a

reason why the majority are already engaged in one form of organic farming practice or the other. This means that farmers' attendance aligns with their engagement in organic farming, proving that most people are practising some level of organic farming practices because they know about it. However, more knowledge might be required to increase their level of engagement in organic farming practices in the area.

The results in Table 1 further indicate that more than half (52,12%) of the farmers had no secondary occupation, meaning they derive most of their income from farming activities.

This agrees with Myeni *et al. (2019),* who states that due to the high unemployment rate, most South African rural populations rely primarily on agriculture for food security and subsistence.

TABLE 1: Socioeconomic Characteristics of the Smallholder Farmers

Characteristics	Frequency	Percentage %	Mean (SD)
Age (Years)			
≤25	8	10	35,70 (9,74)
26-50	63	78.75	
51 and above	9	11.25	
Gender			
Females	40	50	
Males	40	50	
Marital Status			
Unmarried	56	70	
Married	24	30	
Family size			
≤5	26	32,5	7,21 (3,52)
6-10	43	53,75	
11 and above	11	13,75	
Farming experience (Years)			
≤10	65	81,25%	7,48 (6,18)
11-20	12	15%	

21 and above	3	3,75	
Farm size			
≤ 5	43	53,75	6,68 (5,49)
6-10	25	31,25	
11 and above	12	15	
Formal education			
0	3	3.75	9,89 (5,21)
1-6	23	28,75	
7-12	27	33,75	
13 and above	26	32.5	
Farm visit			
No	23	28,75	
Yes	57	71,25	
Engagement in organic farming			
No	4	5	
Yes	76	95	
Organic Farming training attendance			
No	24	30	
Yes	56	70	
Membership in farmer group			
No	47	58,75	
Yes	33	41,25	
Secondary Occupation			
No	41	51,25	
Yes	39	48,75	

3.2. Perceived Benefits of Organic Farming Practices Among Smallholder Farmers

Using the mean value, the perception of smallholder farmers on the effects of organic farming practices was rated. Table 2 reveals that the smallholder farmers had a high and positive perception

of the benefits and effects of organic farming practices. Some prominent statements they agreed to indicate their high level of perception were that it is safe for the environment (MS = 4,64), which ranked first. Other prominent statements highlighted by the farmers were, "Improves the soil`s quality and health" (MS = 4,34) and boosts long-term productivity in a pollution-free environment (MS = 4,31). This implies that smallholder farmers believe that organic farming practices are safe for the environment. These results are in line with the findings of Singh (2021), who stated that organic farming aids in improving the fertility of the soil and the environment need to be nurtured as a resource to be husbanded for future generations.

Furthermore, it does not employ synthetic-based pesticides and fertilisers (4,29). This aligns with Thamaga-Chitja and Hendriks (2008), who reported that organic farmers discourage the use of synthetic pesticides or fertilisers. The use of genetically modified organisms is not permitted (4,25). According to Patidar and Patidar (2015), overusing chemical inputs over the past four decades has caused numerous hazards, including soil erosion, groundwater level contamination, soil salinisation, pollution from fertilisers and pesticides, genetic erosion, negative effects on the environment, decreased food quality, and increased cultivation costs. Overall, smallholder farmers have a good and correct perception of the use of organic farming practices; therefore, all relevant stakeholders should support and facilitate strategies to enhance the upscaling of its use in the area.

TABLE 2: Respondents perceived benefits of organic farming practices

Perceived effect	Strongly disagree Freq (%)	Disagree Freq (%)	Undecided Freq (%)	Agree Freq (%)	Strongly Agree Freq (%)	Mean	Rank
It is safe for the environment	0 (0,0)	0 (0,0)	0 (0,0)	29 (36,3)	51 (63,7)	4,64	1st
It boosts long-term productivity in a pollution-free environment	0 (0,0)	3 (3,8)	3 (3,38)	40 (5,0)	34 (42,5)	4,31	3rd

It yields a crop with great nutritional value	0(0,0)	2 (2,5)	2 (2,5)	51 (63,7)	25 (31.3)	4,24	6th
It is challenging to gain certification	15 (18,8)	17 (21,3)	15 (18,8)	20 (25,0)	13 (16,3)	2,99	12th
It necessitates a high cost of production.	5 (6,3)	17 (21,3)	14 (17,5)	35 (43,8)	9 (11,3)	3,33	8th
Improves the soil`s quality and health.	0 (0,0)	0 (0,0)	1 (1,3)	51 (63,7)	28 (35,0)	4,34	2nd
Improves plant disease resistance	13 (16,3)	15 (18,8)	10 (12,5)	29 (36,3)	13 (16,3)	3,18	9th
Increase genetic diversity	7 (8,8)	21 (26,3)	16 (20,0)	26 (32,5)	10 (12,5)	3,14	10th
Encourages people to use natural pesticides more	4 (5,0)	8 (10,0)	9 (11,3)	19 (23,8)	40 (50,0)	4,04	7th
Pests, illnesses, and weeds are all controlled	13(16,3)	20 (25,0)	4 (5,0)	33 (41,3)	10 (12,5)	3,09	11th
The use of genetically modified organisms is not permitted	1 (1,3)	6 (7,5)	11 (13,8)	16 (20,0)	46 (57,5)	4,25	5th
It does not employ synthetic-	2 (2,5)	3 (3,8)	11 (13,8)	18 (22,5)	46 (57,5)	4,29	4th

based pesticides and fertilisers							

3.3. Utilisation of Organic Farming Practices among the farmers

The list of organic farming techniques is ranked in order of severity using the mean score. The results in Table 3 show the respondent's mean score using a 3-point utilisation scale of frequently used (3), occasionally used (2) and not used (1). According to the results in Table 4, weed management was the most prominent practice among farmers in the area, ranking 1st with a mean score of 2.74. This implies that smallholder farmers use this practice more often since it helps crops grow properly. Some weeds consume more water and nutrients, which causes the target crop to perish due to a lack of necessary requirements. Tasks related to weed control can be made much easier and more feasible with the help of a well-thought-out strategic plan, which can also result in significant resource savings (time, effort, and money). Therefore, for weed management tactics to be successful enough to support lucrative and long-term cropping systems, they must be based on a strong foundation of sound agronomy (Peerzada *et al.,* 2019).

Furthermore, Table 3 results reveal that the majority (MS = 2.66) of smallholder farmers used crop rotation, mainly because crop rotation helps to enhance soil quality, better distribution of nutrients in the soil and increases biological activity. (Gido *et al.,* 2013) also postulated that crop rotation is a tried-and-true method for changing weather, crop, and field conditions. Crop rotation has been known for centuries to increase yield and plant health (Schöning *et al.,* 2022).

Table 3 shows that the majority (MS = 2.60) of the farmers frequently used organic-related soil management practices. This implies that most smallholder farmers emphasised the importance of organic soil management, saying that healthier crops result from managing the soil. This result is in conformity with Shah and Wu's (2019) findings that agricultural scientists have known for a long time that good soil management methods are crucial for boosting the output of agricultural produce and reducing environmental pollution. Thus, it is important to adopt methods that prevent soil contamination and deterioration and preserve soil from erosion, directly contributing to a lack of available land.

Moreover, the results in Table 3 further indicate that under two-thirds (62,5%) of smallholder farmers indicated that they use green manure and compost (MS = 2.59) as regular applications that enhance soil structure and nutrients. Neto *et al.* (2020) pointed out that in addition to affecting the development and yield of crops, applying organic matter (OM) to the soil via compost or green manure for several years in a row also modifies the soil's chemical composition. Table 3 also indicates that under two-thirds (62.5%) of smallholder farmers utilise crop diversity (MS = 2.55). A study revealed that such practice may be used because it helps offset the other enterprise's generated income (Redlich et al., 2018).

TABLE 3: Distribution of Respondents Based on Organic Farming Practices Utilised By Smallholder Farmers

Organic farming practices	**Not used**	**Occasionally used**	**Frequently used**	**Mean**	**Rank**
	Freq (%)	Freq (%)	Freq (%)		
Crop diversity	3 (3,8)	27 (33,8)	50 (62,5)	2,59	5th
Crop rotation	4 (5,0)	16 (20,0)	60 (75,0)	2,70	2nd
Green manure and compost	2 (2,5)	28 (35,0)	50 (62,5)	2,60	4th
Biological pest control	12 (15,0)	28 (35,0)	40 (50,0)	2,35	8th
Mechanical cultivation	10 (12,5)	35 (43,8)	35 (43,8)	2,31	10th
Application of organic compost	2 (2,5)	32 (40,0)	46 (57,5)	2,55	6th

Reduced tillage	5 (6,3)	44 (55,0)	31 (38,8)	2,33	9th
Cover cropping	18 (22,5)	28 (35,0)	34 (42,5)	2,20	11th
Soil management	3 (3,8)	21 (26,3)	56 (70,0)	2,66	3rd
Weed management	3 (3,8)	15 (18,8)	62 (77,5)	2,74	1st
Controlling other organisms	6 (7,5)	34 (42,5)	40 (50,0)	2,42	7th

Value in parenthesis signifies percentages*

3.4. Constraints Faced by Smallholder Farmers In Utilising

The results in Table 4 indicate the respondent's results where the mean score was derived from 3 3-point severity scale of very severe (3), moderately severe (2) and not severe (1). Using mean score to rank the constraints lists according to their order of severity, prominent constraints items indicated by members as severe challenges impeding smallholder farmers from adequately utilising organic farming practices were " inadequate government assistance support" (MS= 2,48), "Vagaries of climate change" (MS= 2,38), " inadequate access to grants, donations, and credit facilities" (MS=2,31), "inadequate collaboration and collective action among farmers" (MS= 2,28), "inadequate access to extension services (MS=2,15), and " lack of knowledge about organic farming practices" (MS= 2,03), ranked 1st,2nd,3rd,4th,5th, and 6th respectively.

The results in Table 4 reveal that inadequate government assistance support ranked as the (MS = 2.48) topmost severe constraint smallholder farmers face in their optimal utilisation of organic farming practices in the area. This clearly shows that most smallholder farmers are not receiving adequate support from the government. These results are supported by Sivaraj *et al.* (2017), who stated that smallholder farmers perceived a lack of government support for marketing organic produce as a major constraint. This is followed by the vagaries of climate change, which are the second most severe (MS = 2.38) constraints indicated, and both are related. The survey showed that farmers

need assistance from the government since they encounter a lot of damage from high temperatures and other weather conditions that are not good for their cultivation. This agrees with Harvey *et al.* (2018), who revealed that a lot of smallholder farmers are struggling to cope with the effects of climate change, and the majority are already feeling the effects on crop yields, pest and disease incidence, revenue generation, and, in some cases, food insecurity.

The results from Table 4 revealed inadequate access to grants and credit facilities (MS = 2.31) was the third most severe constraint in the area, which may be due to a lack of expertise, particularly among those over the age of 51 who lack a strong educational foundation and are not receiving government extension services. This result collaborates with the findings of Soni *et al.* (2012), who reported that some constraints faced by smallholder farmers during the adoption of organic farming practices were lack of financial condition, availability of loans and lack of proper training at the grassroots level through agricultural extension services and establishing information networks amongst them. This is also related to the 4th severe constraint in the area, inadequate collaboration and collective action among farmers (MS = 2.28). This indicates that collaboration and collective action is lacking among farmers in the area. This implies that more needs to be done to encourage farmers in the area to work together in groups and cooperatives for increased output and income.

TABLE 4: Constraints Faced by Smallholder Farmers

Constraints	**Not severe**	**Moderately severe**	**Very severe**	**Mean**	**Rank**
	Freq (%)	Freq (%)	Freq (%)		
Vagaries of climate change	11 (13,8)	28 (35,0)	41 (51,2)	2,38	2nd
Difficulties of obtaining organic	29 (36,3)	37 (46,3)	14 (17,5)	1,81	7th

fertilisers and inputs					
Inadequate access to extension services	19 (23,8)	30 (37,5)	31 (38,8)	2,15	5th
Lack of knowledge about organic farming practices	24 (30,0)	30 (37,5)	26 (32,5)	2,03	6th
Land ownership issues	58 (72,5)	8 (10,0)	14 (17,5)	1,45	8th
Inadequate access to grants, donations, and credit facilities	16 (20,0)	23 (28,7)	41 (51,2)	2,31	3rd
Inadequate government assistance support	11 (13,8)	20 (25,0)	49 (61,3)	2,48	1st
Inadequate collaboration and collective action among farmers	14 (17,5)	30 (37,5)	36 (45,0)	2,28	4th

***Mean Score derived from very severe=3, moderately severe=2, not severe=1**

10.17159/2413-3221/2025/v53n1a18444

3.5. Farmers' Socioeconomic Factors Influencing Utilisation of Organic Farming Practices

The results in Table 5 show smallholder farmers' socioeconomic determinants influencing the utilisation of organic farming practices using a multiple linear regression model. The results revealed that multicollinearity between the variables employed in the model was not a challenge. The Variance Inflation Factor (VIF) test for multicollinearity revealed that the computed mean VIF value was 1.12, and the tolerance values for the variables were also high. The model's adjusted R-squared was 0.1024, and the F-test statistic was 2.29, with a statistical significance of $p < 0.01$. This indicates that the model fits well and that the parameters are not statistically equal to zero. Two out of 7 independent variables fitted into the model were found to be significant determinants that influence the smallholder farmers' utilisation of organic farming practices. These significant socioeconomic factors include formal education ($t=1.89$, $p\leq0.10$) and organic farming training attendance ($t=1.\ 71$, $p\leq0.10$). The study results showed that the coefficient of formal education (0.0991901) of the smallholder farmers was statistically significant at $p < 0.10$ and positively influenced the utilisation of organic farming practices. This implies that farmers with access to formal education have better opportunities to enhance their understanding of possible positive effects. They are most likely to scale up the adoption of organic farming practices. This agrees with Myeni *et al.* (2019), who postulated that farmers with more formal education are more likely to adopt innovative sustainable agriculture management techniques such as organic farming practices. Furthermore, the coefficient of organic farming training attendance (1.115976) of the smallholder farmers was statistically significant at $p < 0.10$ and positively influenced the utilisation of organic farming practices. This implies that smallholders would have higher utilisation if they were aware and attended more training through agricultural advisory services to increase their knowledge of the benefits of organic farming, which, in turn, will lead to an improved livelihood, as opined by Altenbuchner *et al.,* (2017), who stated that one of the important aspects of farmers' livelihoods is increased agricultural knowledge through training and extension services on organic farming.

TABLE 5: Socioeconomic Determinants of Smallholder Farmers' Utilisation of Organic Farming Practices

Characteristics	Coefficient	Standard Error	T-value	P > t	VIF	Tolerance
Gender	-0.7131783	0.5353752	-1.33	0.187	1.01	0.990582
Family size	0.098987	0.0789102	1.25	0.214	1.07	0.931143
Farming Experience	-0714628	0.0482482	-1.48	0.143	1.24	0.809353
Farm Size	0.0605971	0.0497611	1.22	0.227	1.04	0.961319
Formal Education	0.0991901	0.0524798	1.89	0.063*	1.04	0.962576
Farmer Group	0.3739794	1.310191	0.29	0.776	1.15	0.870530
Organic Farming training attendance	1.115976	0.6543191	1.71	0.092*	1.27	0.789493
Constant	25.81832	1.628793	15.85	0.000		
F	2.29					
Prob > F	0.0036					
R-Squared	0.1820					
Adj R-squared	0.1024					
Mean VIF					1.12	

Note: Statistical Significance *P < 0.10

4. CONCLUSION AND RECOMMENDATIONS

This study examined the perception and utilisation of organic farming practices among smallholder farmers in South Africa using Mpumalanga Province as a case study. The study's overall findings showed that smallholder farmers believe that organic farming practices are safe for the environment, improve soil quality and health, and boost long-term productivity in a pollution-free environment. Moreover, smallholder farmers were aware of organic agricultural methods, and the adoption of organic practices is still yet to be widespread and optimal in the area. This is due to severe challenges the study exposed, including inadequate government support, the unpredictability of climate change, inadequate access to grants, donations, and credit facilities, inadequate collaboration and collective action among farmers, and inadequate access to extension

services. Furthermore, the study found that socioeconomic factors such as formal education and organic farming training attendance were significant determinants influencing smallholder farmers' utilisation of organic farming practices. Therefore, based on these findings, the study suggests that smallholder farmers could achieve sustainable cultivation and adopt organic farming practices. The study recommended that increased government support, adequate access to credit facilities and significant improvement and effectiveness of extension services in providing training and encouraging collective action among the smallholder farmers is required.

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Coping Strategies Against Food Insecurity By Agricultural Food Security Pack Programme Beneficiaries: The Case of Mpulungu District, Zambia

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ABSTRACT

Climate variability, programming gaps and poor agricultural extension services hinder small-scale farmers' agricultural productivity in Southern Africa, Zambia inclusive. These agricultural challenges have not spared Zambia's food security pack programme beneficiaries. Using a mixed method design, this study investigated other economic activities that the 147 vulnerable farming households pursued, besides relying on the food security pack programme in the Mpulungu district. The study established that unpredictable rainfall, late delivery of farming inputs, and poor agriculture extension services were the major challenges that affected the productivity of the beneficiary households. To mitigate these challenges, the findings revealed that the beneficiaries grew crops other than those provided under the programme. Also, most respondents pursued other livelihood strategies such as receiving remittances from migrant relatives, petty trading, safety nets, and wage labour. The study concludes that the beneficiaries pursued other economic activities to enhance household food security apart from relying on what the programme provided. The study recommends investment intensification in agricultural research to produce pro-poor drought-resistant crop varieties, timeous distribution of farming inputs to beneficiaries, increasing extension staffing levels to bridge the staff-farmer ratio gap, and introducing in-service refresher training for agriculture extension staff.

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1. INTRODUCTION

Agriculture is the mainstay of many economies of Southern African countries, Zambia inclusive. Most governments prioritise agricultural food production in their national development plans to feed citizens. Small-scale farming is key to national development through its contribution to food security; hence, most governments craft sound policies that do not leave behind small-scale farmers in developing economies like Zambia. In Zambia, over 55% of the population dwells in rural areas, with about 90% dependent on agricultural food crop production through small-scale farming (Word Bank, 2021). In aggregate, small-scale agriculture provides most of the food produced in Zambia. With the potential of small-scale farming, the Zambian government implements agricultural food programmes designed to promote small-scale farming and enhance productivity. The notable agriculture-oriented food programmes are the Farmer Input Support Programme, the Food Security Pack Programme, and the Food Reserve Agency Crop Marketing Programme.

The farmer input support programme aims to improve the resource-impoverished small-scale farmers' access to improved agricultural inputs to enhance household and national food security and incomes through increased food and cash crop production (Kaoma & Mpundu, 2023). The programme targets individual small-scale farmers who can pay the prescribed farmer contribution of K400.00 and, at the same time, they should be members of registered farmer organisations in their localities (Kaoma & Mpundu, 2023). In contrast, the Food Security Pack programme empowers the poor and vulnerable small-scale farmers with free agricultural inputs and livelihood skills to improve their productivity to enhance their food, nutrition and income security (Kafula, 2017). On the other hand, the food reserve agency marketing programme aims to purchase agricultural food crops from farmers, especially small-scale farmers who are located in economically disadvantaged areas in Zambia, to provide income for them and maintain a sustainable strategic food reserve for the nation (Mulungu & Chilundika, 2016).

Notwithstanding the importance of all the programmes presented above in supporting small-scale farmers, the interest of this study was the food security pack programme because of its design to

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deal with the poor and vulnerable small-scale farmers. Under the popular rainfed cropping, the food security pack programme beneficiaries are provided with a farming inputs package through the Ministry of Community Development and Social Services, consisting of selected cereal seed, legume seed, potato vines (optional), cassava cuttings (optional), basal and top-dressing fertiliser, and lime for areas with acidic soils (Kafula, 2017). These inputs are meant to help the beneficiaries grow food crops such as cereals, including sorghum, maize, millet and rice; legumes, including beans, cowpeas, soya beans and groundnuts; and sweet potatoes and cassava crops.

Regrettably, despite the provision of accessible farming inputs by the Zambian government to vulnerable small-scale farmers in Mpulungu district, there have been reports of poor agricultural productivity among the beneficiaries that ultimately affect their household food security (Nkomoki, Bavorova & Banout, 2019). The poor agricultural productivity is attributed to several natural factors, such as floods, drought, heatwaves, and pest infestation. In contrast, other operational factors include poor road infrastructure and over-dependence on rainfed cropping. Others are institutional and include factors such as poor agriculture extension services and inadequate extension staff (Nkomoki *et al.,* 2019). A study conducted to investigate the causes of seasonal household food insecurity in Mpulungu district revealed that 37% of the households were food secure throughout the year. In comparison, 25% were food insecure in critical periods. Also, 21% were temporarily food secure due to food crops that could not last until the next harvest period, while 17% were food insecure all year round (Goma, 2012).

There have been few or no attempts to establish how vulnerable small-scale farmers coping with poor agricultural productivity due to the abovementioned factors affecting household food security in Mpulungu district. This study, therefore, sought to establish other economic activities that the food security pack programme beneficiaries pursued, other than reliance on the programme, to enhance household food security in the Mpulungu district of Zambia. Specifically, the study focused on establishing the amount of maize and bean crops harvested by the respondents, challenges that the respondents encountered, whether the respondents grew food crops other than those prescribed under the programme or not; and other sources of income.

The study results supplement the existing knowledge that may assist policymakers, implementers, and planners, among other interest groups, in understanding the strengths and limitations of some poverty reduction programmes. The study's recommendations can help backstop and improve policy formulation for similar poverty reduction programmes. Also, the findings may present prospects for new research to address gaps that have not been covered in this study, considering present development policy debates.

2. LITERATURE REVIEW

2.1. The Concept of Food Security

Food security is "when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (Wen & Berry, 2018:1). It is difficult to discuss the concept of 'food security' in isolation from the concept of 'food insecurity' which is said to be food shortage either at the global, continental, national, community or household level (Wen & Berry, 2018). The food shortage at any societal level is the gap between production and consumption (Graham, 2016). Graham (2016) found that, in many instances on a global scale, food production has increased, but food insecurity persists regionally and locally. For this reason, Wen and Berry (2018) point out one significant paradigm shift in the evolution of the 'food security' concept and the discussions surrounding it since the World Food Conference in 1974. According to Wen and Berry (2018), the fundamental shift in thinking about food security from the global and national to the household and individual levels is a breakthrough in efforts to combat food insecurity.

Many of the population could be living in hunger and starvation, even if the nation has plenty of food in the aggregate, all year round (Khaled, Cross & Gasim, 2018). Similarly, many people could be living in hunger during periods of crisis, even though the country has adequate food supplies (Khaled *et al.,* 2018). For this reason, sufficiency in an aggregate does not automatically guarantee adequacy and capability at the household or individual level. What matters is to have access to the available food. Wen and Berry (2018) further explain that the world has ample food and the growth of global food production has been faster than the unprecedented population growth of the past forty years but many developing countries and hundreds of millions of poor people do not have a share in this abundance. They suffer from food insecurity, which is mainly caused by a lack of

production, supply, and purchasing power (Graham, 2016).

The leading trigger of food insecurity is chronic poverty, which results from the absence of economic opportunities to produce adequate food or exchange labour for income to purchase adequate food (Graham, 2016). Eduardo (2017) explains that other factors affecting food security at the global, continental, national, community, household and individual levels include ethnic conflicts, civil war and armed conflicts among nations, such as the Russia-Ukraine and the Israel-Hamas wars. Such conflicts contribute to socio-political unrest and hinder human and economic development programmes, resulting in food insecurity among nations dependent on nations at war for food supplies. For example, Russia's war in Ukraine has disrupted global agricultural markets and worsened food insecurity among nations worldwide already dealing with the lingering shocks from COVID-19 (Priyanka & Pallavi, 2022).

2.2. Food Security Programmes

As a result of various factors discussed above, which affect agricultural productivity and food security at different societal levels, many nations worldwide implement food security programmes for the affected communities to counter food insecurity.

2.2.1. Food Security Programmes: Studies From Four Selected African Countries

Four selected food security programmes from four countries, namely Malawi, Rwanda, Ethiopia, and Zambia, were implemented and evaluated by the International Federation of Red Cross, Red Crescent Societies and the local Red Cross Societies in collaboration with the governments of the respective countries were reviewed.

2.2.1.1. Malawi's Integrated Food Security Programme

Maize crop and citrus production in the Mwanza district of Malawi has been failing for over a decade due to droughts, thereby subjecting households to food insecurity (Malawi Red Cross Society, 2012). As a result, the Malawi Red Cross Society introduced the integrated food security programme in 2011 to lessen the food insecurity of vulnerable communities by implementing diversified food and cash crop production in the district (Malawi Red Cross Society, 2012). The programme targeted vulnerable households with few resources and required long-term support

(Kassie, Hailemariam, Moti, Marenya & Erenstein, 2015). These households received start-up agricultural input packages namely crop seeds, beehives, goats and pigs, tools, irrigation equipment, fertilisers and chemicals (Malawi Red Cross Society, 2012).

After two years of implementation, the assessment of the programme, using participatory methods, revealed increased availability of food and access to it by the family members of the benefiting households (Kassie *et al.,* 2015). Further, the income base for the beneficiary households increased because of the sale of their agricultural products, enabling them to take care of their household requirements (Kassie *et al.,* 2015). However, despite the positive effects, the programme implementation was affected by high inflation coupled with fuel and foreign currency shortages, which negatively impacted the programme during its two years of execution (Kassie *et al.,* 2015).

2.2.1.2. Rwanda's Livestock Rotation Programme

Most of Rwanda's rural population, which subsists on small-scale farming, is vulnerable to food insecurity due to environmental shocks (National Institute of Statistics of Rwanda, 2015). As a result, the Rwanda Red Cross Society initiated a livestock initiative in 2008 in some selected communities throughout the country to make communities resilient to sudden disasters by introducing a holistic recovery approach to address food insecurity and livelihood challenges (Rwanda Red Cross Society, 2012). The households in selected communities were given cattle, pigs, goats, rabbits and other livestock to raise for their livelihoods on a rotation basis.

An assessment of the programme, using community participatory approaches and household surveys to establish the programme's effect on the food security situation and livelihoods of the beneficiaries in Huye, Gisagara and Kayonza districts, revealed successes. Despite challenges experienced, such as land scarcity, shortage of extension services, high costs of constructing modern livestock sheds, and lack of livestock market information, the results revealed that the majority of beneficiary communities' livelihoods were made stronger in a sustainable manner. Some households were able to sell some livestock products to realise some income (World Food Programme, 2012). Also, beneficiaries could put aside money for other household requirements, such as payment of school fees and health insurance.

2.2.1.3. Ethiopia's Integrated Food Security Development Programme

The persistence of food insecurity in rural parts of Ethiopia, one of the poorest countries in Africa with a population of over 80 million people, led to the introduction of the integrated food security development programme by the Ethiopian Red Cross Society in the Tigray region in 2009 (Ethiopia Central Statistical Agency, 2013). The programme's objective was to improve alternative agricultural production and lessen vulnerability to enhance the income of 2,259 vulnerable households in the Dedba, Dergajen and Shibata sub-districts of Enderta (Belay & Dawit, 2017). The vulnerable households were given cash loans, crossbreed cows, beehives, chickens, citrus seedlings and vegetable seeds for alternative livelihoods. Though the programme experienced some challenges, such as limited resources, difficulties in identifying beneficiaries, and misapplication of cash loans, an assessment of the programme after four years of implementation, using a community participatory approach, revealed improvements in household food security and incomes of the beneficiaries (Ethiopian Red Cross Society, 2012).

2.2.1.4. Zambia's Zambezi River Basin Initiative Project

Along the coastal areas of the Zambezi River in Zambia, households are displaced by floods every rainy season (Zambia Red Cross Society, 2016). The displacement of households along the Zambezi basin each year affects their household food security (World Bank Group, 2021). Consequently, the Zambia Red Cross Society introduced the Zambezi River Basin Initiative project in 2012 to lessen the impact of disasters targeting 22,000 vulnerable households susceptible to floods in Sesheke and Kazungula districts of the western and southern provinces of Zambia (Zambia Red Cross Society, 2016). The target households were provided with seeds for maize, cowpeas, cabbages, tomatoes, and rape. Also, goats and chickens were given to beneficiary farmers as starter packs.

The assessment of the project using community participatory approaches and household surveys revealed that the project promoted the adoption of the best food livelihood practices among the beneficiaries in the Sesheke and Kazungula communities. The study showed that most beneficiaries adopted organic manure to improve their soil and enhance its fertility which made their crops grow well and ultimately increased their yields significantly (World Bank, 2021). As a result of the increased yields and harvests, families of the benefiting households could eat three

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meals a day. On the other hand, the lack of coherent partnership with the government stakeholders at district levels hindered the smooth implementation of some critical decisions during the implementation of the project (Zambia Red Cross Society, 2016).

3. METHODOLOGY

3.1. Research Design and Sampling Procedure

A mixed methods design employing both qualitative and quantitative approaches was used in this study. This design was used because it allowed the solicitation of descriptive and numerical data from the questionnaire respondents, interviews, and observations to realise objectivity and diverse views on the subject of study (Creswell, 2017). The study used non-probability sampling, utilising a purposive procedure to select the Mpulungu district as an area of study (Lury, 2018). This technique was also utilised in choosing the technocrats, the District Community Development Officer and District Agricultural Coordinator, as key informants for interviews. The study used probability sampling employing a simple random procedure to select the 147 vulnerable small-scale farming household heads aged eighteen (18) years and above as respondents. This sample size was determined using Slovin's formula (Glen, 2020).

3.2. Data Collection and Analysis

Researcher-administered questionnaires, interviews, and observations were used to collect data. Semi-structured questionnaires were used to collect respondents' biographic data, the amount of maize crop harvested, challenges of the food security pack programme, and other economic activities pursued by the respondents. Semi-structured interviews were used with the District Community Development Officer and District Agriculture Coordinator as key informants and technocrats in the study. The study used semi-structured observation to observe the homestead status physically and passively during visitations to questionnaire respondents (Flick, 2014). The combination of questionnaires, interviews, and observations was key in ensuring the validity and reliability of data (Creswell, 2017).

Descriptive statistics presenting frequency distributions and percentages were generated using the Statistical Package for Social Sciences (SPSS) to compare the variables of interest (Lury, 2018).

Qualitative data was analysed by developing a classification system that helped generate categorical variables/themes subjected to analysis using SPSS software (Flick, 2014).

4. RESULTS AND DISCUSSION

4.1. Sample Characteristics

4.1.1. Sex of the Respondents

Of the 147 respondents, 51% were males, and 49% were females. Thus, the study had almost equal representation, with males being slightly more than females, as shown in Figure 1 below. These findings were supported by the outcome of the interviews with key informants who said that male-headed households dominated the food security pack programme. Further, key informants explained that males were more than females on the programme because some were imposed by politicians due to their role in politics during campaign periods.

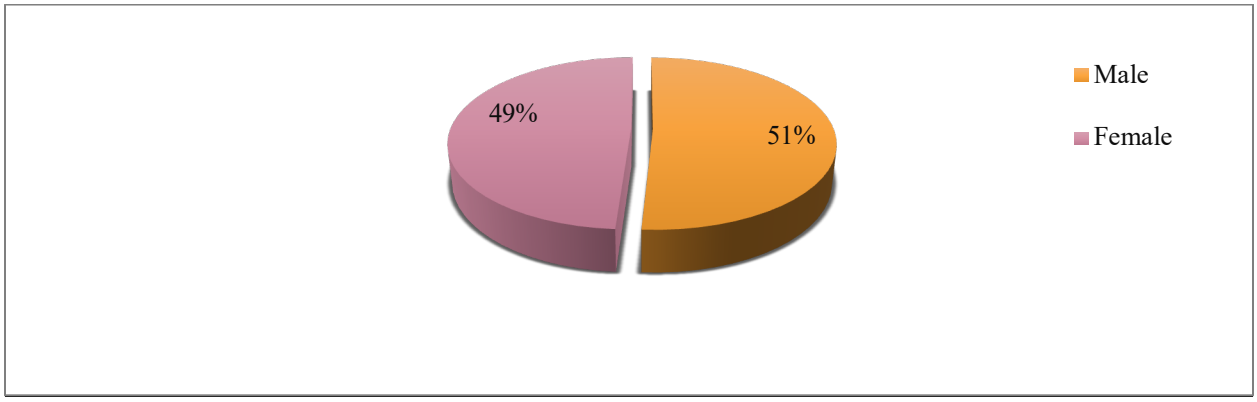

FIGURE 1: Sex of the Food Security Pack Programme Research Participants

The results presented above contrasted with the backing for more female-headed households to be prioritised on poverty reduction programmes because they are classified among the most vulnerable groups (Yenilmez & Celik, 2019). The implication of these findings is that female-headed small-scale farming households in the Mpulungu district would continue to be classified among the most vulnerable groups to food insecurity.

4.1.2. Household Family Size of the Respondents

The majority (41%) of the participants had a family size of more than ten (10) members in a household, while the least (26%) had between one and five family members, as shown in Table 1 below.

TABLE 1: Household Family Size of the Respondents

Characteristic variable	FSPP household heads n = 147	FSPP household heads % = 100
Household family		
1 to 5 members	38	26
6 to 10 members	49	33
Above 10 members	60	41

Notes: **FSPP =** Food security pack programme **n =** number of respondents **%** = percentage

A high number of family members is seen as an advantage among small-scale farmers in rural communities as a labour force that can help to achieve high agricultural productivity. The explanation above confirms an argument that small-scale farmers with a big family labour force realise greater yields per hectare because family labour has more incentives than hired labour (Palacios-Lopez, Christiaensen & Talip, 2017). The bigger the family size, the more comfortable the household heads are, as productivity is enhanced in rural areas. As such, to realise a significant family size, most men in rural areas resort to polygamy and embrace extended family ties (Palacios-Lopez *et al.,* 2017). Therefore, it is implied that most of the respondents had large family sizes because of the assumption that the bigger the family size, the higher the productivity and comfort experienced by the families of the small-scale farmers.

4.2. Maize and Beans Crops Harvested by the Respondents

On maize harvests, 69% of the respondents harvested less than five 50kg bags of maize grain on average per 0.25 hectares of land before accessing the food security pack programme compared to 5% who harvested the same number of bags of maize grain on the same size of the land after accessing the programme. However, after accessing the programme, 70% of the respondents

harvested more than 20 (50kg) bags of maize grain per 0.25 hectares of land compared to 3% that harvested the same amount of maize crop on the same size of a piece of land before accessing the food security pack programme as shown in Table 2 below. The results of the bean crop harvested were similar to those of the maize crop, as shown in Table 2 below. Like the maize crop harvested, 62% of the respondents harvested less than five 50kg bags of beans crop before accessing the food security pack programme compared to 9% who harvested the same number of bags of beans crop on the same land size after accessing the programme.

TABLE 2: Maize and Beans Crops Harvested by the Respondents

Characteristic variables	Before access to FSSP		After access to FSPP	
	n =147	% =100	n = 147	% =100
No. of 50Kg bags of maize crop				
Less than 5	101	69	7	5
5 to 10	15	10	14	9
11 to 15	15	10	16	11
16 to 20	12	8	7	5
21 and above	4	3	103	70
No. of 50Kg bags of bean crop				
Less than 5	91	62	14	9
5 to 10	27	18	22	15
11 to 15	10	7	29	20
16 to 20	12	8	16	11
21 and above	7	5	66	45

Notes: FSPP = Food security pack programme **n** = number of respondents **%** = percentage **Kg** = Kilogramme(s)

After accessing the programme, 45% harvested more than 20 (50kg) bags of bean crops compared to 5% that harvested the same amount of bean crop on the same size piece of land before accessing the programme, as shown in Table 2 above.

There was higher maize and bean crop productivity after respondents' access to the food security pack programme than before, implying that the programme contributed to increased productivity

of both maize and bean crops among the beneficiaries. However, even with increased harvests due to the accessible farming inputs received under the programme, seasonal household food insecurity persisted among some beneficiaries in the Mpulungu district (Goma, 2012).

4.3. Challenges of Food Security Pack Programme: Beneficiaries' Perspectives

To understand the persistent seasonal household food insecurity among some food security pack beneficiaries in the Mpulungu district, the study solicited views from the respondents on the challenges they encountered with the food security pack programme. The majority, 40% of the 147 respondents, contended that unpredictable rainfall was the major challenge faced by the food security pack programme. In comparison, 24% and 16% mentioned the late delivery of farming inputs and poor agricultural extension services provided under the programme, respectively, as shown in Figure 2 below. Other challenges cited were the limited choice of crop seeds provided under the programme and political interference.

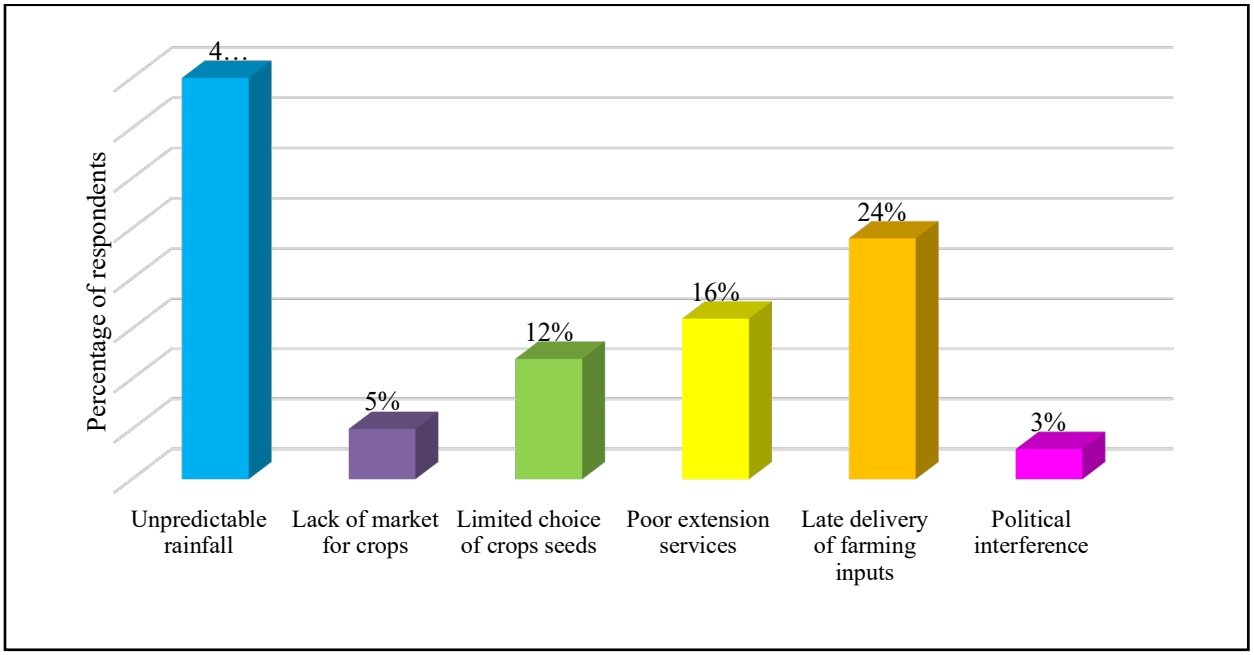

FIGURE 2: Beneficiaries' Perspectives on Challenges Faced by the Food Security Pack Programme

The unpredictable rainfall mentioned by most respondents as a major challenge resonates with an explanation that the possibility of rainy days in the Mpulungu district is unpredictable and varies

during the year (Weatherspark, 2019). The district encounters intense seasonal variations in rainfall, with the period of rains yearly expected to last for seven months with a sliding 31-day rainfall of about 0.5 inches from October to May, though unreliable (Weatherspark, 2019). The unpredictable rain affects planting planning, which has a bearing on agricultural productivity.

The outcome of interviews with the Zambian government officials confirmed the respondents' response that the government's late delivery of farming inputs to the recipients was one of the major challenges. The interviews revealed that the beneficiaries of the food security pack often received farming inputs after the recommended period for planting, which is the first week of November. The Zambian government officials explained that the late distribution resulted from the failure of the Zambian government to release funds to suppliers in time to purchase farming inputs.

The submission by the respondents on poor extension services as a challenge agrees with an argument that agricultural field workers are either inadequate or lack essential technical training or field experience to provide the much-needed extension services to farmers (Qwabe, Swanepoel, Van Niekerk & Zwane, 2022). A lack of refresher training for agricultural extension employees compounds the problem because Zambia's current extension service delivery system does not embrace extension in-service refresher training (Somanje, Mohan & Saito, 2021). Lack of refresher in-service training can result in providing the farmers with outdated extension service information that may lead to a loss of trust in the public extension service delivery system and, ultimately, low acceptance and adaption to innovation that may affect production and productivity (Hlatshwayo & Worth, 2019). In Zambia, there is an increase in the farmer population with an increased demand for agricultural extension services without a corresponding increase in the number of extension workers, resulting in a poor extension officer-to-farmer ratio which stands around 1:1136 (Somanje *et al.,* 2021).

4.4. Food Security Pack Beneficiaries' Engagement in Other Economic Activities

The study sought to establish whether the respondents grew crops other than those provided under the food security pack programme, along with other economic ventures they pursued to caution against household food insecurity in times of poor harvests.

4.4.1. Growing of Additional Crops by the Respondents

Fifty-nine (59%) of the respondents indicated that they grew other crops besides what was received under the programme. In comparison, 41% denied having grown crops other than what they were given under the programme, as shown in Table 3 below.

TABLE 3: Growing of Additional Crops by the Respondents

Characteristic variable	FSPP household heads n = 147	FSPP household heads % = 100
Additional crops grown		
Yes, grew other crops outside the	87	59
FSPP	60	41
No, depending on the FSPP	-	-
Could not remember		

Notes: **FSPP** = Food security pack programme **n =** number of respondents **%** = percentage

Most of the respondents grew other crops besides what was provided under the food security pack programme. Through observations, some fields with common additional crops, such as carrots, cabbages, onions, sugarcane, and bananas, could be seen in home backyards and fields closer to the respondents' homes during dispensing questionnaires. More crop varieties were said to have been grown to help curb household food insecurity in times of distress that may arise due to internal and external shocks such as late delivery of inputs and effects of climate change, respectively. Also, some respondents opted to grow additional food crops because of the programme's limited choice of crop seeds. This justifies an argument that the food security pack programme, in its current state, does not give small-scale farmers options on what to grow (Kafula, 2017). Currently, the Food Security Pack programme enhances maize cultivation with fertiliser use rather than encouraging crop diversification. This situation denies vulnerable small-scale farmers the choice of what to grow.

4.4.2. Income-Generating Activities Pursued by the Respondents

Apart from the agriculture-related activities, the study sought to establish the non-farm income-generating activities the respondents pursued before and after accessing the programme to mitigate the anticipated vulnerabilities, such as changes in seasonality and socio-economic shocks.

The majority, 38% of the 147 respondents, received support from remittances from their migrant relatives after accessing the food security pack programme, compared to the majority, 66%, got support from the same before accessing the programme. Eighteen (18%) of the respondents did petty trading as a source of income after accessing the programme, compared to 14% who pursued the same business venture before accessing the programme, as shown in Figure 3 below. Other sources of income mentioned were social safety nets and engagement in farm labour to earn a wage.

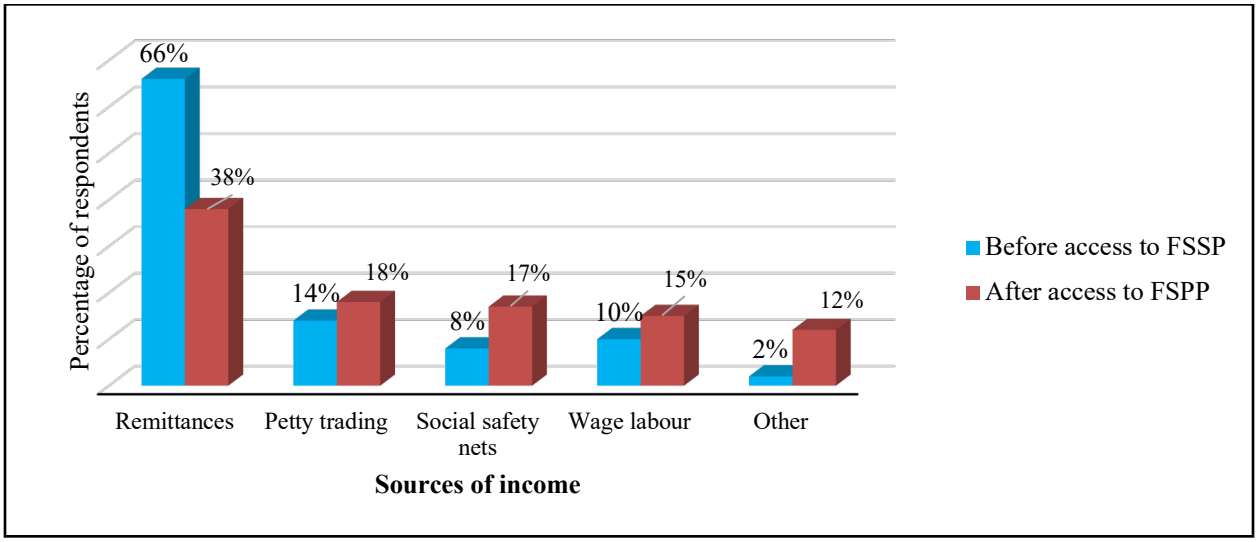

FIGURE 3: Sources of Other Household Income of the Respondents

Notes: FSPP = Food security pack programme

Fewer respondents received support from remittances after accessing the programme than before, and more respondents were in petty-trading business after accessing the programme. It can be argued that fewer respondents relied on support from remittances after accessing the programme, compared to the previous period, because most relied on the food security pack programme for their livelihood. On the other hand, it can be argued that before accessing the programme, they received more remittances than they did after accessing the programme, which was a cushion

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against household food insecurity.

More respondents were engaged in petty trading after accessing the Food Security Pack Programme than before because most remittances they received might have been channelled to petty trading as they were food-secure, whereas before they accessed the programme, most remittances received may have been channelled to food because of household food insecurity. Remittances as a source of livelihood were vital in supporting the respondents' households before and after they had access to the food security pack programme. This confirms that remittances play a significant role in helping small-scale farmers access other vital goods and services that require purchasing power (Generoso, 2015).

The findings on remittances agree with the study conducted in Mali on the effects of remittances on household food security in rural areas. They showed that households receiving remittances in Mali had an improved status of household food security in the Saharan zone compared to those without remittances, but the benefit was impermanent (Generoso, 2015). Similarly, a study conducted in Burundi with a focus on remittances and household wealth for post-conflict households revealed that in households that belong to the category of poor wealth, remittances improved their finances and household food security status (Fransen & Mazzucato, 2014). Remittances, petty trading, social safety nets, and wage labour presented in Figure 3 above are "sources of financial capital" under the livelihood assets component of the Sustainable Livelihood Framework (Generoso, 2015). Financial capital is key to cushioning household food insecurity of the vulnerable small-scale farmers, as it allows them to acquire goods and services, such as fertilisers, crop seeds, pesticides, transportation of surplus produce to markets, and foodstuffs.

5. CONCLUSIONS AND RECOMMENDATIONS

In most cases, agricultural poverty reduction programmes, like the food security pack in Zambia, are affected by an array of interconnected challenges that hinder the crop productivity of vulnerable small-scale farming households, resulting in household food insecurity. These challenges manifest as climate variability, programming gaps, and institutional lapses. The programme beneficiaries must devise mitigation measures to sustain their livelihood against such challenges. Unpredictable rainfall, late delivery of farming inputs, and poor extension services were the major challenges that

the food security pack beneficiaries encountered in implementing the food security pack programme in the Mpulungu district of Zambia.

The food security pack beneficiaries pursued several coping mechanisms to mitigate the effects of poor crop productivity due to the challenges mentioned above. These coping strategies include growing indigenous drought-resistant crops outside what was provided under the programme, engaging in petty trading, which involves selling and purchasing goods and services on a small scale, engaging in farm labour to earn a wage, and receiving remittances from migrant relatives. Owing to the challenges mentioned above that the food security pack beneficiaries met and the corresponding initiatives they pursued to mitigate their effects, the study recommends an intensified robust investment in agricultural research and development to produce pro-poor drought-resistant crop varieties and timeous distribution of farming inputs to the beneficiaries. Also, increasing extension staffing levels to bridge the staff-farmer ratio gap and introducing in-service refresher training for agriculture extension staff would improve extension services.

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