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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.

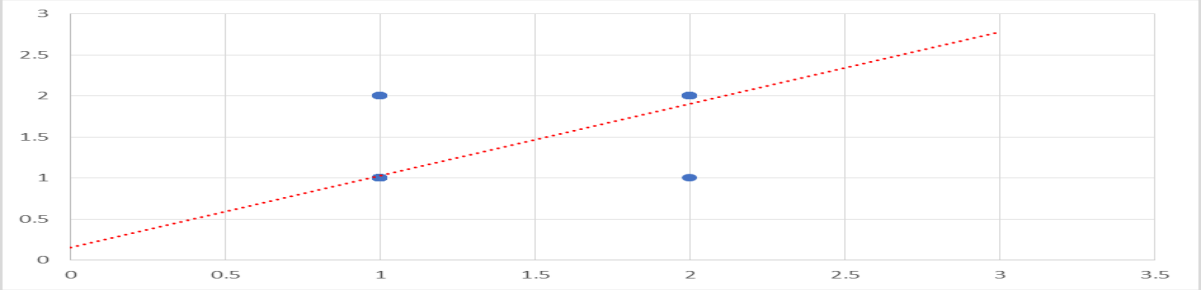

FIGURE 2: Chi-square Statistic on the Relationship Between Agricultural Education and the Utilisation of UIFCs

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.

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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.

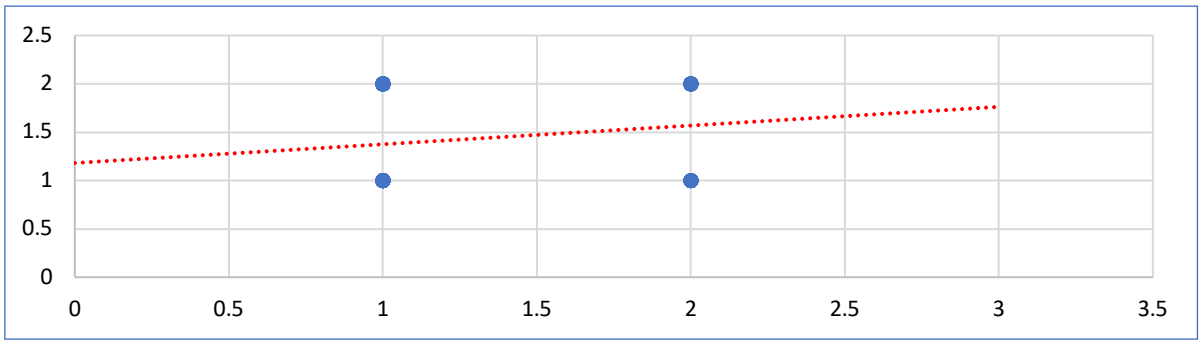

Figure 3: Technology Use in the Production of UIFCs

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

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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