



Report 2021

**RE-IMAGINING Agricultural Extension
through a Learning Lens (RAELL)
*South Africa Report***

Project partners: Centre for Researching Education and Labour (REAL) University of Witwatersrand and University of Nottingham, *with Gulu University and Zimbabwe University.*

Project Funder: University of Nottingham, Global Challenges Research Fund (GOV.UK)

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Please cite as:

Mushangai, D., Chakona, G. and Muhangi, S. (2021) *Re-Imagining Agricultural Extension through a Learning Lens (RAELL) – South Africa Report*, RAELL Project, [pdf]

Available at: www.vetafrica4-0.com/raell.

RE-IMAGINING AGRICULTURAL EXTENSION THROUGH A LEARNING LENS

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CHAPTER 1: HISTORY, BACKGROUND AND CONTEXT OF AGRICULTURAL EXTENSION

1.1 The Role and Purpose of Agricultural Extension Officers (AEOs) in South Africa

1.1.1 A broader history of AEOs over time: through a learning lens

This section reports on the transformation that has occurred in extension curriculum and the practice of extension in South Africa since 1912. It provides a context for re-imagining a curriculum suitable for extension officers in addressing current and future smallholder farmer challenges. Ideas influencing the education of extension officers and the practice of extension are embedded in dominant theories and themes on rural development impacting policy thrusts in certain contexts and periods (Ellis and Biggs, 2001). Regarding global rural development approaches, the 1960s has been characterised as the age of modernisation, the 1970s as the age of state intervention, the 1980s as the age of market liberalisation and the 1990s as the age of participation, whilst the current period has been defined as the age of sustainable livelihoods. It is within these broad rural development approaches, ideas, and the way they are understood in different contexts and at different periods upon which extension curriculums and practices have been practiced. These changes are reflected in the definitions of extension in different periods as outlined below.

In the 1960s Bradfield, (1966), noted that extension personnel have the task of bringing scientific knowledge to farm families in their farms and homes to improve the efficiency of agriculture. In the 1970s, Maunder, (1973) defined agricultural extension as a service or system that assists farm people through educational procedures in improving farming methods and techniques, production efficiency and income to improve their living levels and lift their social and educational standards. In the 1990s the Neuchatel Group, (1999) sees the essence of agricultural extension to facilitate interplay and to nurture synergies within a total information system involving agricultural research, agricultural education, and a vast complex of information-providing businesses. These definitions point to changes in the focus of extension through time.

Extension curriculum and practices reflect the dominant ideology and development approaches of a period regarding ways of knowing and doing. From modernisation in the 1950s to current sustainable livelihoods practices, changes have been realised in the relationship of extension officers and the farmers away from the 'jug and mug' (banking system of the 1950 and 60s) to participatory approaches starting from the late 1980s involving working, learning and doing together with farmers in resolving farming and rural development challenges. Within the broader rural development approaches, Mutizwa-Mukute (2010) identified four critical succession phases in the evolution of extension curriculums, learning and the practice of extension in southern Africa. Table 1.1 below provides the phases in the evolution of extension and approaches to learning characterising each phase.

Table 1.1. Different learning approaches to extension (adopted from Mutizwa-Mukute, (2010))

Learning Approach	Characteristics
Technology Transfer for the colonial and apartheid state	<ul style="list-style-type: none"> • Western scientific methods, knowledge and technologies generated at research centres were seen as key to agriculture development and had to be transferred to farmers. The extension approach was to transfer information and knowledge to farmers. It was a top-down research-design-develop-assimilate approach (RDDA-approach). <p><u>Implications for the learning of the AEOs</u></p> <ul style="list-style-type: none"> • The approach neglected agroecology and technologies were expensive for farmers to adopt and maintain. This applied during colonial South Africa.
Farming systems research and extension approach	<ul style="list-style-type: none"> • This approach appreciated that farmers were not a homogenous group and considered the importance of ecological and social conditions. • It recognised the capabilities of farmers to participate in research and development • Growth of system thinking <p><u>Implications for the learning of AEOs</u></p> <ul style="list-style-type: none"> • Western scientific methods, technologies and methods remained central in this approach with sociologists and anthropologists. Regarding South Africa, this approach is linked to the whole-farm approach starting from the 1940s (Mutizwa-Mukute places this in the 1970 and 80s)
Farmer first approach	<ul style="list-style-type: none"> • Gained ascendancy in the 1990s. • Included Farmer Participatory Research; Participatory Technology Development; Participatory Rural Appraisal and Participatory Learning and Action • Considered local knowledge, values, behaviours and perspectives • Farmers' knowledge and indigenous technical knowledge can be combined with western knowledge to solve farming problems in their locales. • Extension officers were to collaborate and work with farmers. • Elements of this approach in South Africa are found in the Small Support Programmes initiated in the 1980s <p><u>Implications for the learning of the AEOs</u></p> <ul style="list-style-type: none"> • The approach helped in developing participatory learning and mediation skills; appreciated farmer's knowledge and extension officers are encouraged to work more in the fields with farmers, thus

	gaining more practical experience.
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<p>People-centred innovation and learning approach</p>	<ul style="list-style-type: none"> • This is an approach that is currently required as indicated in the South African government's definition of agriculture extension. • This includes the Farmer First Approach and caters with both agro-ecological and socio-economic aspects • Emphasises group and collective approaches and sustainability issues are mainstreamed to learning and innovation across systems • Engages the relevance of policy on knowledge and participation of farmers and citizens • Concerned about national food security and community food sovereignty <p><u>Implications for the learning of the AEOs</u></p> <ul style="list-style-type: none"> • Support farmers with innovations IN A CO-ENGAGED, SOCIAL LEARNING WAY
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Mutizwa-Mukute (2010) provides a powerful outline critical in understanding the evolution of extension services in Southern Africa, but such a neat ideological characterisation and periodisation falters when it comes to the cluttered nature concerning the dispersal or transmission of rural development ideas in different historical contexts at different times and the prominence of these ideas at different times in different areas. As noted by Ellis and Biggs (2001), rural development ideas have been and are still unevenly distributed and understood across disciplines, learning centres, think-tanks, development agencies and national governments in a way that is mirrored in different approaches to extension by different organisations in different areas and at different times (Ellis and Biggs, 2001). Ideas emerging within a certain period usually come to prominence in next decades or so of their emergence. Mushangai (2015) noted that:

Ideas do not emerge from a vacuum; they are rooted in people's beliefs as determined by their histories and experiences. Some ideas emerge and vanish over time but the central maxims upon which these ideas were hinged remain and form the basis upon which new developmental paradigms are found (p. 28).

Moreover, literature indicates that the evolution of rural development approaches and the reflection of this in extension curriculums and practices did not mean a complete abandonment of former curriculums and extension practices but an addition of new ideas, extending former ideas to resolve gaps identified over time (Liebenberg, 2015). Any attempt to portray evolving rural development ideas related to extension curriculums and practices as definitive and contained within certain places and historical periods risks oversimplification.

1.1.2 A synthesis of the evolution of extension services in South Africa

The practice of extension in South Africa has transformed since extension services were initiated in 1912. In the early 1900s, extension officers were imported from Europe (Van Vuren, 1952). The unfamiliarity of imported specialists with local agricultural conditions

caused local farmers to disregard their advice as of practical value. For this reason, the first South African agricultural scientists familiar with the local conditions were sent to study abroad starting from 1907 (Liebenberg, 2015). By 1910 South Africa had managed to build agriculture technical support services consisting of many specialist services each focusing its branch without central coordination (Liebenberg, 2015). This was the phase of highhanded specialists in the development of the extension services, whereby western knowledge was imposed on local communities.

The aforementioned period was followed by the introduction of the concept of 'agricultural demonstration trains' in 1914 aiming for close and personal contacts between farmers and extension (Liebenberg, 2015). This development contributed towards proving the Department's goodwill to a sceptical farming community on the role and effectiveness of extension services during this time in South Africa (Liebenberg (2015). Linked to this concept was the concept of cooperative demonstrations that was introduced in 1920. This concept was employed in determining the reaction of crops, pastures, and fertilizers to the environment. The result was then used as demonstration trials to enable farmers to see for themselves to become convinced (Van Vuren, 1952). Farmers were also taken on tours to observe the work of farmers who were considered successful so that they may adopt the same practices and technologies (Liebenberg, 2015). According to Liebenberg (2015), through personal contact, the Division of Extension succeeded in proving the value and in realising the importance of a more integrated approach to farmer support. However, the focus of this period was on crops, pastures, fertilisers and not on empowering farmers to make sense of their environments to improve their livelihoods. Thus Worthy (2006 in Mutizwa-Mukute, 2010) noted that the colonial government approached extension from a technology transfer mode, conveying to farmers technologies to improve production. Success was measured by the uptake of technologies and not the empowerment of the farmer to make informed decisions to resolve his/her challenges. This was the modernization approach whereby western researched agriculture knowledge and technologies were transferred to African communities to modernize them. Extension officers played the role of an information intermediary between the farmer and knowledge producers during this period. There was therefore a lack of ownership of the knowledge production process on part of the farmer which brought about challenges regarding implementation.

In the 1940s, the position of a Welfare Officer was introduced in South Africa. The Welfare officer was concerned with agriculture, education, health, housing, home economics etc. Also, a lot of effort was put in during this time to enable alignment and integration in the administration of farmer settlement, credit provision, and in directing technical support to resettled farmers. This led to the development and implementation of the whole-farm approach which considered the relationships between the various farming activities in the 1940s. The whole-farm approach emphasised the study of farming under local conditions and called for a decentralised approach to extension (Van Vuren, 1952). This approach led to the establishment of eight regional offices to enable customised services as related to the differentiated needs of farmers in different regions of South Africa (Liebenberg, 2010). Although this approach brought about customised solutions to farmers' challenges, it did not revolutionise extension approaches to learning and interacting with the farmers. The whole-farm approach was still

focused on bringing in ideas to solve the problems of farmers in bringing about agriculture and rural development. There was no attempt at empowering the farmer by facilitating his/her participation in knowledge generation and innovation processes. This phase in South Africa contains elements of what Mutizwa-Mukute (2010) referred to as the Farming Systems Research and Extension Approach which according to Ellis and Biggs (2001) gained prominence internationally in the 1980s.

Starting from the 1970s extension services changed to focus on farmer study groups instead of individual contact visits. The farmer study groups were participatory and provided opportunities for farmers to generate and share knowledge amongst themselves. Further changes were released in the 1980s with the introduction of the Farmer Support Programmes (FSP) in 1983. The programmes aimed to promote structural change from subsistence agriculture to commercial production (Van Rooyen, 1995). This was to be achieved by providing incentives and comprehensive agricultural support services and to existing farmers (Van Rooyen, 1995). The FSP focused on developing small-scale homeland farmers by integrating agricultural and non-agricultural activities in promoting rural development. The FSP approach was redefined following an evaluation in 1989 to enable farmers a wide range of support services including finance capital, inputs, mechanisation, marketing, extension services, demonstration, research and training (Liebenberg, 2015). The FSP approach was multi-pronged, addressing multi-faceted challenges in promoting rural development. The focus was on addressing both the structural and micro-level factors affecting farmers' production. This period in South Africa included elements of both the preceding Farming systems Research and Extension Approach and also of the Farmer First Approaches as identified by Mutizwa (2010). There was a drift during this period towards increased appreciation of farmer's knowledge with officers working together with farmers in the fields. This period was defined by participatory rural appraisal, actor-oriented research and development, stakeholder analysis, and participatory technology development (Ellis and Biggs, 2001; Mutizwa, 2010). The role of the extension officer was increasingly becoming that of a facilitator and a knowledge broker.

1.1.3 The current situation of extension services

In South Africa, extension is currently defined as:

A systematic process of working with farmers or communities to help them acquire relevant and useful agriculture or related knowledge and skills to increase farm productivity, competitiveness and sustainability. In practice, it is a continuum, ranging from the narrow technology transfer that brings changes in farming practices without considering the overall societal perspectives to advisory, education and human development where it takes on critical public priority issues (e.g., food security, poverty alleviation, environmental degradation and social equity). The advisory service, which is very much part of the extension, is normally provided by subject matter specialists, private organisations or firms to support commercial interests. It is commonly practised where agriculture is highly commercialised or farmers have attained a high degree of competence and can articulate their demand for services and

approach extension officers or advisors for advice (Department of Agriculture- DoA, 2005)

It includes technical knowledge, facilitation, brokering, coaching of different actors to improve market access, dealing with changing patterns of risk and protecting the environment (DAFF, 2011).

The above South African government's definition of extension shows about knowledge to improve productivity and risk assessment, competitiveness and market access through knowledge and technology transfers and also focuses on overall societal perspectives to advisory, education and human development to address critical public priority issues (e.g., food security, poverty alleviation, environmental degradation and social equity). All of these areas of intervention are critical regarding agriculture and rural development to achieve the government's systemic transformation agenda (i.e., to reverse the skewed apartheid accumulation structure which has resulted in a dual economy structure within the agricultural sector).

The many issues addressed in the definition implies that extension officers are supposed to interact with stakeholders and farmers in resolving agriculture and rural development challenges. The current South African government's definition reflects the need to empower farmers by building their capabilities for sustainable livelihoods. In this, extension officers are supposed to play various roles as intermediaries, facilitators, knowledge and innovation brokers to bring about farmers' empowerment of farmers by enhancing their participation in knowledge generation and application process to improve innovation activities, market access, and also ownership of the market. The current South African government's definition contains elements of Mutizwa's (2010) People-centred innovation and learning approach partly focused on supporting farmers with innovations in a co-engaged, social learning way. The focus is on building sustainable livelihoods, good governance, environment and sustainability, poverty eradication and mainstream gender and development (Ellis and Biggs, 2001). Shaxon et al's (2011) dimension of an extension officer as an intermediary, a translator, and a knowledge and innovation broker are considered in defining extension roles. However, literature and stakeholders indicate that the practices of officers have remained largely at the level of intermediaries and translators. It is only in private organisations where the roles of officers have been extended in practice to include knowledge and innovation brokering.

1.2 The Role and Purpose of AEOs Arising From This Project (RAELL)

This section provides an overarching perspective on the key themes and issues that emerged from this project regarding the role and purpose of AEOs, the challenges involved, and how these are changing with time. These were drawn from analysis of data from a number of interviews conducted in this study, the occupational role profile (ORP) data, the current extension curriculum, and examples of learning and the practice of extension, and show that:

- There is dissonance between what extensionists say they are doing and what farmers say they do, the processes that AEOs believe they follow and the processes they actually follow,

and what they say they will achieve and their actual outcomes.

“The AEOs should make the farmers to be more confident in them as they do different farming strategies, they need to know their work and should always be with the people in order to know the needs of these farmers. The AE profession is not an office professional work where one has to be behind the desk.”

- Currently, there is a mistaken assumption that if one has agriculture knowledge, then one can automatically teach/advise the farmer. The complexities of knowledge dissemination are not considered currently, hence most extensionists, especially those from former Universities of Technology, focus on knowledge transfer rather than empowering the farmer. There is an unrealised need for sociology and a new methodology that puts the focus on doing, working and learning with the farmer.
- Current limitations on policy impacting curricula emanate from the government having an extension policy and an agriculture policy and many agriculture regulations. Extension policy and agriculture policy often don't speak to each other. The extension is mostly about how to implement government policy to improve GDP and not how to develop farmers. No space is given to farmers to make decisions but tries to convince them to join a project, use technology. Existing extension qualifications follow the traditional approach of extension focusing on production-related knowledge and skills, technology transfer and negotiation/persuasion and behavioural change to adopt and implement new technology without a focus on fostering learning capacity among farmers.
- The quality of extension curricula varies across education institutions hence the need for standardisation. Traditional universities and universities of technology hence the need for standardisation have different approaches to extension.
- Extension as a subject of learning is barely included in mainstream agricultural qualifications such as the Diploma in Agriculture and the Bachelor of Science in Agriculture.
- Despite policy changes to develop a single integrated extension service serving all farmers, most HEIs still offer programmes that are capital-intensive and meant for commercial agriculture. Issues of smallholder farming, food security, rural livelihoods and sustainable agriculture scarcely feature in the curricula.
- Though the role of the extension officer is defined in government policy documents to include knowledge and innovation brokering in reality the role has remained at the level of an information intermediary and a knowledge translator.
- Data from interviews indicates that extension officers provide farmers with farm inputs including hybrid seeds and seedlings, herbicides and pesticides to control pests and diseases in the farms. Extension officers also provide farmers with “knowledge and skills” through “on-site demonstration” and “information days” to train farmers.

“we identify what the farmers need to be assisted on. Then we organise information days to a particular topic that has been identified. We are in the liberty to co-opt other specialists in the department or outside, even in the

private sector, even in NGOs, to come from out of our information days. So that is how, besides the meetings, that is how we educate. As our extension officers organise those information days”-Extension officer

- Extension officers also collaborate with farmers to find solutions for water challenges farmers face especially livestock farmers whose animals suffer during droughts. Extension officers provide support in “cleaning and digging dams” to avail water during seasons of drought. Extension officers also mentioned that they play a central role in assisting farmers to “apply for funding and grants” from the department of agriculture and other local economic development agencies at local municipalities.

“Every year livestock farmers apply for grants to dig or clean dams for the water. Not all applications are accepted.... at least out of 20, 3 or 5 are approved... and we assist farmersto apply and also dig the dams to get animals water”-Extension officer

- Extension officers also “organise” farmers in existing each ward (a group of up to 8 villages) into “commodity groups” to make it easy to support and supervise farmers

“So, the duty of this extension officer is to identify what is being done in the ward and also organise those people in the ward to form commodity groups, where we'll find out in villages to have about six commodity groups that are operating or existing. Talk about those who are focusing on oil production, for those of red meat production, that is those who were keeping cattle and goats, we have their field crops, those who are growing grain, pumpkin. So, we have categorised those ones as the field crops one, they are operating on dry land”.- Extension officer

- Another critical role of extension officers in South Africa is their participation in land reform processes by working with other organisations directly involved in land reform.

“We do assist in terms of issues of land reform, because we're working together with our sister Department of Land Reform, which is usually called land affairs. These name changes, they are now called land reform. Okay, so as to identify people who may meet the requirements, so that they can be land reform beneficiaries. Okay, so do we play a role in helping to identify those people? And then we head over to those people to do their land reform to the department even though that has not been happening lately”.-Extension Officer

1.3 Methodology

This report employed a historical-sociological approach in understanding the current South African extension policy, extension curriculum and education, and extension practices. Historical documents were employed in tracing the evolution of extension in South Africa since its commencement in 1912. Contemporary documents were analysed to understand and capture the complexities regarding the extension curriculum and current practices in South Africa in addressing the needs of farmers of different capabilities.

Semi-structured interviews were employed to gather data from policymakers, extension lecturers at colleges and universities, farmers and extension officers. The interview questions were developed by a team of researchers from the University of Nottingham, Rhodes University, University of the Witwatersrand, Gulu University and the University of Zimbabwe. Four interview schedules were produced, one focusing on farmers' understanding of extension, another focusing on extension officers' understanding of extension – their knowledge and practices. The third schedule focused on lecturers to understand the influence of the current extension curriculum on extension practices. The fourth schedule focused on policymakers, how policies are made and how they influence extension curriculums and the practice of extension in South Africa.

On extension policy, four interviews were conducted- one with one of the top officials at the Directorate of Extension Reform one with a top official at Limpopo Extension Services and the last one with a professor at one of the Universities in Kwazulu-Natal province with broad experience in South Africa's agricultural extension policy. Five farmers, one farmers' focus group discussion and five extension officers were interviewed to get the perspectives of farmers and extension officers. Lastly, two lecturers from institutions that offer AE programmes were also interviewed to understand extension from a curriculum point of view. All interviews were conducted online using zoom due to covid-19 regulations that limited physical meetings. Purposive sampling was employed to identify the research participants (key informants) believed to have relevant information on the subject matter. All in all, 17 interviews were conducted.

Desktop analysis was also employed in understanding extension from a curriculum point of view, the provisioning of AE programmes across South Africa and the progression in AE qualifications and labour market. This was done through the analysis of qualifications on the South African Qualifications Authority (SAQA) website where all qualifications are registered, with the NQF levels as well as analysing the HEMIS data. In analysing occupational role profiles and workstreams, agricultural extension job adverts published on websites accessible in the public domain were collected and analysed to understand the demands of their job market and implications on extension education. These provided a glimpse of the required qualifications, skills and competencies in an agricultural extension officer.

The final document is a thematic exegesis of historical and contemporary data, interview data and the analysis of extension job adverts in South Africa on various job sites.

2. CHAPTER 2: SCOPE OF AGRICULTURAL SECTOR IN SOUTH AFRICA

2.1 Institutional Mapping: Networks, Roles and Relationships

The study conducted actor scoping for all institutions involved in agricultural extension services in various capacities. The actor mapping process identified institutions and individuals involved in agricultural extension training and practice at formal, non-formal and informal levels in South Africa. These actors derive from a broad range of areas, including the NGO sector (community-based organisations and international non-governmental organisations), corporates organisations (corporate social responsibility), agricultural colleges, universities (and affiliated researcher centres), industry/sector research and training institutions, farmer associations, extension professional bodies, and National government and provincial agencies. Table 2.1 shows the broad categories of the mapped institutional actors involved in skills development within the agricultural extension ecosystem in South Africa.

Table 2.1. Institutions involved in agricultural extension services in South Africa

Type of institution	Institution name
Community-based organisations	Lima Rural Development Foundation, SAVE- ACT, Mthathi Training Project, Abalimi Bezekhaya, Oranjezicht City Farm, Enviro Solutions Centre, DWESA-CWEBE property Association, Buhle farmers Academy, Transkei Land Service Organisation, RULIV (Rural and Urban Living), Farm garden National Trust
Agricultural extension training funding institutions	Land and Agricultural Development, Bank of South Africa (Land Bank), Umthombo Agricultural Finance, E-squared, HCI Foundation, DG Murray Trust, Rockefeller Foundation, SAB Foundation, Capital Harvest, Forestry Sector Innovation Fund, Nedbank, Misereor, Jobs Fund, Mellon Foundation, Sugar Association small growers Fund, Anglo American, GIZ (German cooperation), Hans Merensky Foundation, Ackerman's PnP foundation, Northam Platinum, Water Research Commission
Industry/Sector training institutions	AgriSETA, Citrus Academy, Shukela Training Centre, Citrus Research International (Pty) Ltd (CRI), China Eucalypt Research Centre (CERC)

<p>Formal Training and research institutions</p>	<p><u>Universities</u></p> <p>Cape Peninsula University of Technology, Central University of Technology, University of Pretoria (Faculty of Agriculture and Natural Sciences, Agricultural Economics, Extension and Rural Development), Rhodes University (Environmental Learning research centre), University of Venda (School of Agriculture), University of KwaZulu Natal School of Agricultural Earth and Environmental Sciences (SAEES) -Farmer Support Group, African Centre for Crop Improvement (ACCI), Northwest University, University of Mpumalanga, University of Fort Hare, University of Cape Town (African Centre for Cities), Forestry and Biotechnology Institute (FABI), University of Western Cape (South Africa Centre of Excellence in Food Security), University of Free State (Centre for Sustainable Agriculture, Rural Development, and Extension)</p> <p><u>Agricultural colleges</u></p> <p>Fort Cox Agricultural and Forestry Training Institute (FCAFTI), International Agricultural Academy for Africa, Elsenburg Agricultural Training Institute, Owen Sithole College of Agriculture (OSCA), Grootfontein Agricultural Development Institute (GADI), Madzivhandila College of Agriculture, Tompi Seleka College of Agriculture, Glen College of Agriculture, Potchefstroom and Taung Colleges</p>
<p>Advisory consultancies</p>	<p>AFGRI Agri Services, Andisa gri</p>
<p>Professional organisations</p>	<p>The South African Society for Agricultural Extension (SASAE)</p>
<p>National Government and provincial agencies</p>	<p>Department of Agriculture, Land Reform and Rural Development (DALRRD), Dept of Rural Development and Agrarian Reform: Eastern Cape, Directorate of National Extension Support, Agri-Business Development Agency (KZN), Agricultural Research Council (ARC), Department of Small Business Development, Eastern Cape Department of Environmental Affairs, National Lottery Commission, NRF- National Research Foundation, Department of Social Development, Small Enterprise Development Agency (SEDA), National Agriculture Marketing Council.</p>
<p>Farmers' Associations</p>	<p>National Wool Growers Association (NWGA), Cotton SA, Citrus Growers Association, South African Sugar Association (SASA), Olive Growers Association</p>

2.1.1 Relationships among agricultural extension institutions

Figure 2.1. shows the actor-network for mapped institutions involved in agricultural extension services in South Africa. The relationships existing among these institutions are identified and explained.

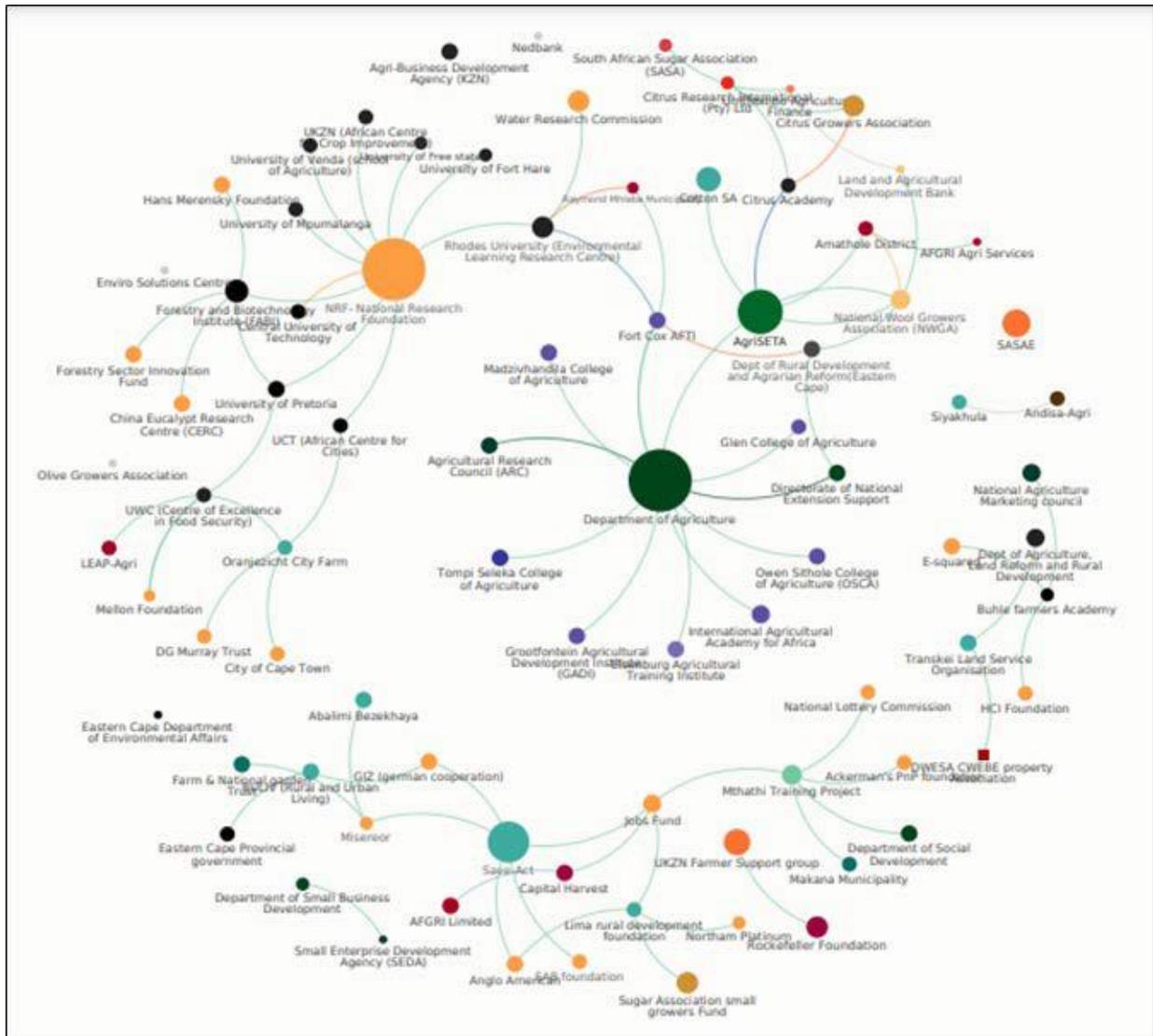


Figure 2.1. Actor Network map of institutions in agricultural extension services skills ecosystem.

Source: Researchers' compilation.

Relationship between the NGO sector and corporate donors. The actor mapping network shows a strong funding collaboration between corporate funding bodies, and these play an active role in supporting learning in the agricultural extension ecosystem for farmers. Community-based organisations and non-government organisations receive financial support from corporate donors.

Government agencies and agricultural training institutions were found to have a close relationship. The department of agriculture closely works with agricultural training institutions especially agricultural colleges. The Agriculture Education and Training Authority

(AgriSETA) is seen to have a close relationship with industry institutions providing extension training and Farmer Associations. For instance, AgriSETA works closely with The Citrus Academy, National Wool Growers Association and Citrus growers Association and Citrus Academy. There is a flow of financial and technical resources among these institutions to provide training and extension services to farmers. For example, the National Research Foundation is central to providing financial resources to universities in the form of bursaries for students.

Limited collaborative relationships among actors. The network shows missing collaborations among organisations in the same sector. For instance, few collaborations exist among organisations in the NGO sector in relation to supporting learning in agricultural extension. There are some connections among organisations in different sectors in training and providing extension services to farmers. Some agricultural extension institutions working in local communities at a local level collaborate to share expertise to offer training for extension officers, providing extension services, conducting research or implementing community projects. There are also missing links between and among training institutions regarding training extension officers or collaborations on skills development programmes for farmer learning.

Government agency relationships. Government departments working in agricultural extension seem to work mainly with the lower government agencies at provincial, district and municipalities to implement extension policies and strategies formulated at a national level. For instance, provincial departments of agriculture implement extension policies formulated by the National Directorate of Agricultural Extension. The agencies provide reporting guidelines for the lower department to provide feedback for national level planning.

2.1.2 Challenges existing in the agricultural extension actor relations

Several factors affect actors' working relationships, which hampers co-learning and actor engagement within the agricultural extension ecosystem.

Insufficient funding: the lack of a sustainable source of finance for some institutional activities significantly impacts the working relationships among actors who work collaboratively. Most industry-linked training institutions, mainly financed by farmer associations, usually face financial shortfalls due to reliance on contributions from the association membership. For instance, the Citrus Academy receives limited funding from AgriSETA, and the Academy covers this gap from the contributions of association members. As a result, the institution admits a limited number of students for training due to limited bursaries. Some actors, such as community-based organisations that depend on donor funding, also face funding instabilities. Also, according to a public extension officer, "funds from the department [of agriculture] are not enough", and so the Department can "support only a small number of [extension] officers to attend short training courses" that require a financial contribution.

Workforce shortages: There are challenges of workforce shortage linked to insufficient funding in organisations offering extension services. According to one agricultural extension officer, the Department of agriculture has not hired the required number of extension officers.

Currently, few extension officers serve many farmers, with some extension officers overseeing “between 500 to 1000 or more farmers”, and this makes it “difficult to serve them all” and “meet each farmer face to face”; hence they advise farmers to “form groups”.

Fewer opportunities to meet face to face: More recently, due to Covid-19, actor interaction such as physical meetings have been affected by the lockdowns and associated Standard Operating Procedures. This makes collaborations challenging.

Transport challenges affect the mobility of some agricultural extension actors to engage in productive work and meetings with clients and other partners. Extension officers in some department offices in rural areas “share vehicles,” and in case other “staff have other engagements and take the vehicle”, then “movement to “meetings” gets affected.

2.2 Roles Supporting the Learning of Agricultural Extension Officers (AEOs)

Concerning supporting the learning of agricultural extension officers (AEOs), the institutional actors play the following roles.

Financing of agricultural extension learning and curricula innovation. Institutions such as the National Research Foundation, Department of Agriculture, AgriSETA and Water Research Commission fund the training of agricultural extension officers and advisors through bursaries and learning projects.

For instance, the Department of Agriculture and AgriSETA have a close relationship with agricultural colleges and agricultural industry-linked training institutions (see Figure 2.2) and provide a significant amount of financial support. Colleges and agricultural sector linked institutes graduate most of the agricultural extension officers in the country.

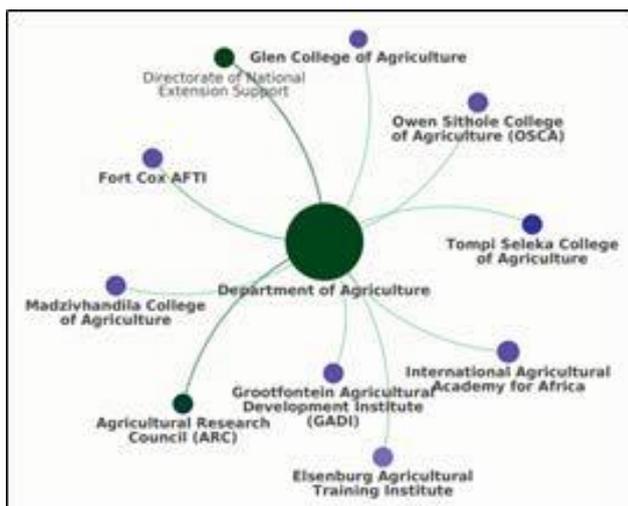


Figure 2.2. Actor-network of the Department of Agriculture and agricultural colleges

(Source: Researchers compilation).

The Water Research Commission funded the Amanzi [water] for Food project run by the

Environmental Learning Research Centre at Rhodes University. The project facilitated extension officer learning at agricultural colleges [Fort Cox], Universities and NGOs on water conservation for small-scale farming and household food security in the Eastern Cape (Lotz-Sisitka et al., 2017). This collaboration (see Figure 2.2) reviewed the Fort Cox Agriculture and Forestry Training Institute (AFTI) diploma in agriculture further to facilitate the formal learning of agricultural extension students.

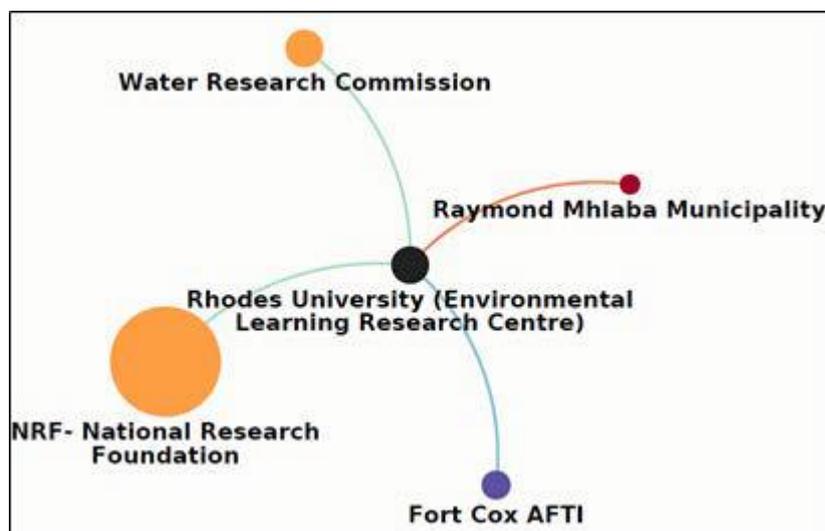


Figure 2.3. Actor-network collaborating to facilitate training of agricultural extension officers

Training programmes: The Institutional actors, especially agricultural colleges, universities and industry training institutes, offer formal training to the agricultural extension officers through various extension-related qualifications. As indicated in chapter 3, the Central University of Technology, Western Cape offers an advanced diploma in agricultural extension, Fort Cox college offers a Diploma in Agriculture, and the Citrus Academy offers a certificate to students related to Citrus production and marketing.

Materials for AEOs learning: The Training institutions (universities and colleges) and donor organisations involved in agricultural extension publish reports and research output that assist in the curricula review and other learning for Agricultural Extension Officers. Some extension officers indicated that they use the “internet to search for new publications” and agricultural extension and farming reports to “keep up to date” with information and better address the farmer needs.

Online learning Platforms: The collaboration in Figure 2.1 between the Environmental Learning Research Centre and the Water Research Commission is an online platform with materials for “the trainer of trainers” courses available to extension officers. Some institutions also offer online webinars and courses to facilitate information sharing and learning of extension officers. One extension officer mentioned that he attends the “Global Forum for Rural Advisory Services (GFRAS)”, which also offers “online courses related to extension”.

2.3 Agricultural Extension Knowledge Flow and Skills

2.3.1 Knowledge flows to AEOs

Agricultural extension officers (AEOs) get their knowledge through various sources, including formal, informal, and non-formal sources.

Formal Sources: All interviewed extension officers mentioned that they had a “formal qualification” in agricultural extension obtained through an agricultural college or a university. The minimum qualification was a diploma in agricultural extension, whereas the maximum qualification was a Master's degree. Most of the AEOs with bachelor's degrees had obtained it through further learning from a diploma. Agricultural extension officers with more than ten years of working experience indicated that the curricula used to train them did not include emerging issues of “climate change” and “use of technology”. In contrast, those that had recently graduated at all levels (diploma, bachelor's, honours, and master's degree) in the last five years knew “sustainability”, “environment”, and “climate change” issues. Other formal sources included textbooks and journals, although very few extension officers consulted these. Some officers still refer to the notes taken during colleges to “update” themselves to better respond to farmer challenges.

Non-formal sources: extension officers indicated that they obtain knowledge from non-formal programmes. Most indicated that they had engaged in learning either in a short course or self-taught methods using the internet to get information. Those who attended short courses stated that short courses mainly were delivered by other organisations, not the Department of agriculture. Many seemed to agree that “a few agricultural extension officers who get learning opportunities” like short courses from their employer (the Department of Agriculture). Only a few AEOs had attended more than two courses in the last five years or since they graduated from school, and many extension officers stated that they “rarely attend the webinars”. The short courses most AEOs have attended were not related to agricultural extension but other topics helpful in extension work such as “social mobilisation”. Extension officers who attended courses related to agricultural extension mentioned “agricultural marketing” and “water management”, with very few mentioning training on “climate change”.

Informal sources: The Knowledge extension officers obtained through informal sources were mainly through interacting with the farmers, social learning networks such as Invoto Bubomi [water for food], and through online materials accessed through the internet. The indigenous knowledge on agroecological practices AEOs acquired was related to “seed saving”, “pest and disease control”, and “irrigation”. Many extension officers identified the “Invoto Bubomi” informal learning network in the Eastern Cape as a significant source of information on “climate change” and networking issues. However, it requires having a “smartphone” and “internet connection” to remain engaged with the community of practice in the learning network “WhatsApp group”.

Knowledge also flows to AEOs in the networks and these types of knowledges located in the network provided to AEOs are:

- Codified (scientific and agricultural knowledge) knowledge which is produced and transmitted formally at individual institutions (universities, research institutions and agricultural colleges). This agricultural knowledge is documented and located in published journals, books and other databases managed by institutions. Agricultural extension students obtain this knowledge through extension qualification training, independent study or provided in non-formal training such as workshops.
- Applied knowledge in the form of contextual, specific topics and general education knowledge available in the networks is generated and acquired by agricultural extension officers from the field as they interact with farmers and other partners within the agricultural extension skills ecosystem. For instance, extension officers learn about farmers' culture, indigenous knowledge and practices, and presentation skills through interacting with farmers.

2.3.2 Learning needs of AEOs

Agricultural extension officers indicated various skills and competency needs with “climate change” and “use of new technologies” emerging as the areas where agricultural extension officers must have skills and knowledge gaps. Most extension officers stated that they need more training on using new “information technology” such as “mobile apps” to obtain knowledge and other information to help them respond to the farmer’s needs. One extension officer mentioned that using technology would help to provide “early warning” information to farmers as “seasons have changed” due to climate change.

Agricultural extension officers also indicated that they need to be trained to “specialise” in a specific area in their field of work to move away from being general practitioners. Some extension officers indicated that if they specialised in areas such as “crop production”, “marketing”, or “animal production”, they would understand “everything around one speciality” to provide farmers with all the knowledge and answer all their questions. One officer shared an instance where an officer felt humiliated after failing to answer some questions from the farmers on a subject he lacked knowledge of. He added that being general practitioners, sometimes, “extension officers get embarrassed when they are called in a rural area to assist a client and when asked a specific question about a farmer’s challenge and do not have a knowledge of it”.

To facilitate their learning on emerging issues, most extension officers highlighted the need for a periodical review of the curriculum used to train extension officers. One extension officer stated that the “curriculum should be reviewed at least after every two years to check if the curriculum is still relevant and if not upgrade it to cater to today’s extension needs”.

Extension officers highlighted the need to learn about business aspects such as “marketing” and “managing finances”. One extension officer stated that the majority of the farmers she worked with “lack these skills” but that she was also “not a professional in these things”. Among the suggestions was that “the Department of higher education, Department of Agriculture, Universities and industry players create more platforms to meet and discuss the

challenges of extension about how to and what is needed in the market”.

3. CHAPTER 3: AGRICULTURAL EXTENSION KNOWLEDGE SUPPLY: Providers, Qualifications, Throughput and Curriculum

3.1 Supply from a Systems Perspective

3.1.1 Current systems of Extension provisioning in South Africa

In South Africa, a number of institutions are providing agricultural training both at Higher Education level and Further Education and Training. Currently, there are eleven Agricultural Training Institutions located in six provinces in the country. These eleven Agricultural Training Institutions are namely Cedara and Owen Sithole Colleges (in KwaZulu-Natal), Potchefstroom and Taung Colleges (in North West), Elsenburg (in the Western Cape), Fort Cox College, Tsolo College and Grootfontein College of Agriculture (in the Eastern Cape), Glen College (in Free State) and Madzivhandila and Tompi Seleka Colleges in the Limpopo province. The Agricultural training institutions provide agricultural vocational education and training, an Agricultural Diploma as a three-year qualification of NQF level 5-7 as well as the vocational skills training to the farming communities as a National Certificate (NQF level 1-4). Apart from the above-mentioned colleges of agriculture, there are also institutions of higher education and training that provide agricultural training as a diploma or degree programme. A mix of qualifications at NQF Level 6-10 are offered at these institutions, and these qualifications include diplomas and degrees in a range of subject areas such as general and mixed agriculture, livestock/animal production, crop production, agricultural extension and rural resource management and development, agricultural economics and agricultural management. The qualifications provided by all these institutions are registered with the South African Qualification Authority (SAQA) and are accredited by the Council of Higher Education (CHE) and/or AgriSETA (Agriculture Sector, Education, Training Authorities) which are the primary or Delegated Quality Assurance functionary in South Africa.

The agricultural training programmes are framed by national qualifications but they are fundamentally flexible to contextualisation as the training institutions orient their courses towards supporting the agricultural activities practiced in their respective regions (DAFF 2008; Lotz-Sisitka et al 2021). Within the agricultural programmes offered by these institutions, some institutions only focus on specific agricultural training with curricula mostly based on teaching commercial agriculture and production (which is context specific), with no component of agricultural extension (AE). However, as informed by internet-based review of Agricultural curricula within institutions offering courses in agriculture, this project found that a number of institutions in South Africa offer one or more courses specific to AE within their diploma/degree programmes as shown in Table 1 below. Agricultural Extension is offered mostly up to Masters levels (NQF level 9) in most institutions, with the exception of the University of Fort Hare and University of Pretoria which offers AE up to doctoral level as Doctor of Agriculture in Agricultural Extension and Doctor of Philosophy in Agriculture: Extension, respectively and both qualifications are offered at NQF level 10 with a maximum of 360 credits.

Table 3.1. Institutions offering Agricultural Extension courses at different NQF levels in South Africa

Institution	Qualification Programme	NQF Level	Minimum Credits	Courses offered directly related to agricultural extension
Cape Peninsula University of Technology	Diploma in Agriculture	06	360	Agricultural Extension 1, 12 Credits; Agricultural Practice, 30 Credits; Agricultural Extension 2a, 14 Credits; Agricultural Extension 2b, 14 Credits; Agricultural Management Information and Systems, 20 Credits (Total credits 90)
	Advanced Diploma in Agriculture and Livestock Production	07	120	Agricultural Extension, 15 Credits
	Advanced Diploma in Agriculture and Crop Production	07	120	Agricultural Extension, 15, Credits.
Central University of Technology, Free State	Advanced Diploma in Agricultural Extension	07	120	Extension and Advisory Principles and Approaches, 24 Credits; Behaviour Change and Intervention in Extension, 18 Credits; Leadership, Group Dynamics and Networking in Extension, 18 Credits; Project Planning, Implementation and Evaluation in Extension, 18 Credits; Agricultural Economics for Extension, 24 Credits (Total credits 102)
Elsenburg Agricultural Training Institute	Diploma in Agriculture	06	360	Communication and Innovation, 10 Credits; Extension in Practice, 15 Credits (Total credits 25)
Fort Cox College of Agriculture and Forestry	Diploma in Agriculture	06	360	Agricultural Extension 1, 8 Credits; Agricultural Extension 2, 12 Credits (Total credits 20)
Glen College of Agriculture	Diploma in Agriculture in Crop Production	06	360	Agricultural Extension and Agricultural Teaching Methods, 12 credits

Grootfontein College of Agriculture	Diploma in Agriculture	06	360	Agricultural Management 1B, 5 Credits; Information Management Systems 1B, 3 Credits; Agricultural Extension 1A, 4 Credits; Agricultural Extension 1B, 4 Credits (Total credits 16)
Madzivhandila College of Agriculture	Diploma in Agriculture Animal Production	06	360	Agricultural Extension I, 10 Credits; Extension II, 10 Credits; Extension III, 10 Credits (Total credits 30)
	Diploma in Agriculture in Plant Production	06	384	Agricultural Extension I, 10 Credits; Extension II, 10 Credits; Extension III, 10 Credits. (Total credits 30)
Mangosuthu University of Technology	Diploma in Community Extension	06	384	Agriculture: Extension IA, 15 Credits; Agriculture: Extension IB, 15 Credits; Agriculture: Extension IIA, 15 Credits; Extension IA, 10 Credits; Agriculture: Extension IIB, 15 Credits; Extension IB, 10 Credits; Agriculture: Extension IIIA, 15 Credits; Extension IIA, 10 Credits; Agriculture: Extension IIIB, 15 Credits; Extension IIB, 10 Credits (Total credits 130)
	Diploma in Agriculture	06	360	none
	Diploma in Agriculture in Animal Production	06	360	Agricultural Extension I, 12 Credits; Agricultural Extension II, 12 Credits; Agricultural Extension III, 12 Credits (Total credits 36)
	Diploma in Agriculture in Crop Production	06	360	Agricultural Extension I; Agricultural Extension II; Agricultural Extension III; Agricultural Practice
	Advanced Diploma in Agricultural Extension and Community Development	07	371	Extension IV, 12 Credits.
	Advanced Diploma in Agriculture in Animal Production	07	120	Agricultural Extension IV, 20 Credits.
	Advanced Diploma in Agriculture in Crop Production	07	120	Agricultural Extension IV, 20 Credits.

North West University	Postgraduate Diploma in Agricultural Extension	08	120	Leadership Development in Agricultural Extension, 16 Credits; Essentials of Agricultural Extension, 16 Credits; Elements of Communication in Agricultural Extension, 16 Credits. (Total credits 48)
	Bachelor of Science in Agriculture	08	120	Agricultural Extension for Development, 8 Credits; Fundamentals of Agricultural Extension, 16 Credits; Communication and Agricultural Technology Transfer, 8 Credits. (Total credits 32)
	Master of Science in Agricultural Extension	09	512	Dissertation on Agricultural extension, 180 Credits.
Owen Sithole College of Agriculture	Diploma in Agriculture	06	180	Agricultural Extension, 10 Credits; Experiential Training Work Integrated Learning (WIL), 60 Credits. (Total credits 80)
Timpi Seleka College of Agriculture	Diploma in Agriculture in Animal Production	06	360	Extension I, 10 Credits; Extension II, 10 Credits; Agricultural Extension III, 12 Credits. (Total credits 32)
	Diploma in Agriculture in Plant Production	06	380	Agricultural Extension I (Introduction to Extension), 10 Credits; Agricultural Extension II, 8 Credits; Agricultural Extension III, 10 Credits. (Total credits 28)
University of Fort Hare	Bachelor of Agriculture in Extension / Production	07	388	Introduction to Agricultural Extension AGX221; Agricultural Extension & Human Development AGX321; Applied Extension & Rural Development AGX322; Seminar in Agricultural Extension AGX323
	Bachelor Science in Agriculture: Economics	07	436	Introduction to Agric Extension AGX221
	Bachelor of Agriculture Honours in Agricultural Extension	08	360	Basic & Philosophy of Agric Extension & Rural Development AGX501; Communication, Leadership & Management AGX502; Evaluation & Research AGX503; Dissertation AGX504

	Bachelor of Science Honours: Agriculture: Agricultural Extension	08	120	Basic & Philosophy of Agriculture Extension & Rural Development AGX501; Communication, Leadership & Management AGX502; Evaluation & Research AGX503; Dissertation AGX504
	Doctor of Agriculture in Agricultural Extension	10	128	Thesis, 360 Credits.
University of KwaZulu-Natal	Bachelor of Agriculture in Agricultural Extension and Rural Resource Management	07	360	The extension, agri-business and natural resource management
University of Limpopo	Bachelor of Science in Agriculture in Agricultural Economics	08	360	Introduction to Agricultural Extension, 12 Credits.
	Bachelor of Science in Agriculture in Plant Production	08	480	Introduction to Agricultural Extension, 12 Credits.
	Master of Agricultural Management in Agricultural Extension	09	480	Agricultural Extension, 16 Credits; Comparative Extension, 16 Credits; Farming Systems Research and Extension, 16 Credits; Adult and Non-formal Education, 16 Credits; Women and Agricultural Extension, 16 Credits.
University of Mpumalanga	Advanced Diploma in Agriculture in Agricultural Extension	07	180	Extension theory and policy context, 30 Credits. Planning extension programmes and projects, 30 Credits. Extension experiential learning, 30 Credits. (Total credits 90)
	Bachelor of Agriculture in Agricultural Extension and Rural Resource Management	07	120	Extension Methods, 16 Credits; Extension Practice, 16 Credits; Designing Extension Projects, 16 Credits; Participatory Extension, 16 Credits; Extension Placement, 32 Credits. (Total credits 96)
	Bachelor of Agriculture Honours in Agricultural Extension and Rural Resource Management	08	384	Advanced extension theory and practice, 15 Credits; Extension research project, 45 Credits. (Total Credits 60)

	Bachelor of Science in Agriculture	08	120	Agricultural Extension, 30 Credits; Agricultural Extension, 30 Credits; Advanced Agricultural Extension, 15 Credits. (Total credits 75)
	Master of Agriculture in Agricultural Extension	09	480	Dissertation
University of Pretoria	Bachelor of Agriculture Honours in Extension	08	180	AGV 715 Principles and approaches of rural development and extension 715 Credits: 15; AGV 726 Extension programme planning and management 726 Credits: 20; AGV 728 Extension programme evaluation and research 728 Credits: 30 (Total credits 65)
University of Pretoria	Bachelor of Agriculture Honours in Rural Development	08	120	AGV 715 Principles and approaches of rural development and extension 715 Credits: 15
	Master of Agricultural Science in Agricultural Extension	09	120	AGV 890 Dissertation: Agrarian Extension 890 Credits 180
	Master of Agriculture in Extension and Rural Development	09	180	AGV 890 Dissertation: Agrarian Extension 890 Credits 180
	Doctor of Philosophy: Agriculture: Extension	10	180	AGV 990 Thesis: Extension 990 Credits: 360
University of South Africa	Diploma in Agricultural Management	06	120	AEX1602 - Community Extension Practice; AEX3703 - Extension Programme Planning and Evaluation
	Advanced Diploma in Agricultural Management	07	360	AEX4701 - Participatory Approaches to Extension
	Bachelor of Science in Agricultural Science	08	480	AEX2601 - Extension Leadership and Group Dynamics; AEX3703 - Extension Programme Planning and Evaluation

	Bachelor of Human Ecology: Community Agriculture	08	519	none
University of the Free State	Postgraduate Diploma in Sustainable Agriculture	08	136	Extension for sustainability, 24 Credits.
University of Venda	Bachelor of Science in Agriculture in Agribusiness Management	08	491	Introduction to Agricultural Extension, 12 Credits.
	Bachelor of Science in Agriculture in Forestry	08	480	Introduction to Agricultural Extension, EXT 3641, 12 Credits.
	Bachelor of Science in Agriculture in Soil Science	08	480	Introduction to Agricultural Extension EXT 3641, 12 Credits.
University of Zululand	Bachelor of Consumer Science in Extension and Rural Development	08	360	Introduction to Extension & Rural Development, 15 Credits; Internship for Extension & Rural Development.
	Bachelor of Science Honours in Agriculture	08	120	none
	Bachelor of Science in Agriculture in Agronomy	08	480	Introduction to Extension and Rural Development, 16 Credits.
	Bachelor of Science in Agriculture in Animal Science	08	480	Introduction to Extension and Rural Development, 16 Credits.
	Bachelor of Science in Agriculture in Agribusiness Management	08	360	Introduction to Extension and Rural Development 15 Credits

3.1.2 Educational enrolments, progression, and throughput

In South Africa, it is important to note that Agriculture is categorised under the Science, Engineering and Technology (SET) field. Statistics on Post-School Education and Training in South Africa DHET (HEMIS, 2018) indicates that the number of students enrolled in the Science, Engineering and Technology (SET) has been increasing between 2010 and 2018. In 2018, the majority of students in public HEIs enrolled in Science, Engineering and Technology (320 671), followed by Business and Management (283 194) and Humanities (267 553). Despite the increase in the number of students enrolled in SET programmes, the number of the graduation rate is still too low to make a difference to the skill pipeline. The graduation rate across all programmes was at 20,3% in 2018 with graduation in SET contributing 28,7% of all graduates in 2018 (DHET, HEMIS, 2018). The low percentage of graduation output indicating that fewer students are completing their studies and obtaining qualifications strain the supply of skills to the agricultural sector. The sector remains unable to fill critical positions. The total number of first year enrolment to undertake Agriculture, agricultural operations and related sciences at South African universities and Agricultural colleges was 19,512 in 2016 (Stats SA, 2017), a significant increase on 2012, when a total of 1,361 first year students were enrolled at the 12 agricultural institutes (AgriSETA, 2014; Lotz-Sisitka et al., 2021). Agri SETA (2014) further reported that, although there has been an increase in the number of first years enrolling for agricultural programmes, the total of graduates seems to be declining as only a total of 535 students graduated from these agriculture colleges in 2012. Table 3.2 shows that the university number of learners graduating in agriculture-related programmes has been increasing from 2016 onwards.

Table 3.2. University graduates (including for UOTs) in agriculture and related subjects in South Africa for the years 2016, 2017 and 2018.

Graduate and CESM	2016	2017	2018
Agriculture, Agricultural Operations and Related Sciences	4504	4596	4991
Agricultural business and management	1503	1576	1777
Agricultural mechanisation	21	26	29
Agricultural production operations	653	651	790
Applied horticulture and horticultural business services	300	255	235
Animal sciences	607	695	692
Plant sciences	535	474	534
Soil sciences	438	448	475
Forestry and wood sciences	177	176	181.9

Agriculture, agricultural operations and related sciences, other	110	141	182
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HEMIS database (2020) for the years 2016, 2017 and 2018 (own formatting)

The HEMIS (2020) data provided above show that the number of students completing agricultural- related courses has been increasing since 2016. However, the data about how many learners were enrolled is not available. This is important to identify pipeline blockages and to calculate the throughput rate. Regarding extension services, the increasing number of students graduating from universities may be an indication of the availability of qualified unemployed extension officers in the job market. The National Director of Extension Reform indicated that the shortage of extension officers is a result of budget constraints to employ more people (Interviewed by Mushangai, Johannesburg, June 2021).

Regarding university training, the major challenge pertains to funding and the lack of expertise in the field of agriculture. The Universities of Stellenbosch, Fort Hare and Free State have been receiving grants for agricultural programmes from the Department of Agriculture whilst students have been funded through the National Students' Financial Aid Scheme (NSFAS) (Greenberg, 2010). Despite the commitment by the government, funding has remained a challenge for the universities concerned to recruit more staff to take in more students (Mushangai, 2020).

The throughput in agriculture related subjects at TVETS colleges has not been high with enrollments fluctuating in other subject areas. Table 2 below shows performance in TVET agriculture related areas.

Table 3.3. TVET enrolments, progression and pass rates in agriculture subjects for 2014, 2015, and 2016: NC (V) Level 4; and Report 191 N6

Year	2014				2015				2016			
	Enrolled	wrote	Pass	pass rate	Enrolled	wrote	Pass	Pass rate	Enrolled	Wrote	Pass	Pass rate
NC (V) Level 4: Primary Agriculture	769	715	219	30.8	755	705	261	37.02	835	768	319	42

Report 191 N6 Farming Management	243	241	80	83	10	9	1	11.1	629	621	379	61.03
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Source DHET statistics, 2020

The above shows that for NC (V) Level 4: Primary Agriculture and Report 191 N6 Farming Management enrollment figures have been fluctuating. There were 769 learners enrolled for NC (V) Level 4: Primary Agriculture in 2014. The number went down to 755 in 2015 and rose to 835 in 2016. However, the percentage rose from 30.8% in 2014 to 37% in 2015 and to 42% in 2016. More than half of those who set for examinations failed in 2014, 2015 and 2016. This is a clear indication of blockages in the agriculture skills pipeline.

The number of learners enrolling for Report 191 N6 Farming Management has also been fluctuating with 243 learners in 2014, 10 in 2015 and 379 in 2016. The pass rate for Report 191 N6 Farming Management was at 83% in 2014, 11.1% in 2015 and 61.03% in 2016. Although 61% pass rate in 2016 is a great achievement considering the dismal pass rate of 2015, there is still a need to push the rate up to improve utilisation of resources.

Moreover, DHET (2016) noted that qualifications in fields such as primary agriculture and education were most likely held by older individuals (45 years and older) and that a lower proportion of black Africans received qualifications in agriculture compared to whites, with close to 56% of qualification holders in agriculture and related fields being white. This presents a problem as more young people are required to replace ageing workers. This also presents transformation challenges in a sector that has been regarded as white dominated.

DHET (2020) statistics shows that the percentage pass rate of learners who sat for Applied Agriculture and Agriculture Technology examinations at CET (GETC: ABET Level 4 Learning Areas by Content) is still low. Only 2410 of 4301 who sat for Applied Agriculture and Agriculture Technology examinations were able to complete their programmes with the pass rate at 56%. This again points to blockages hindering many learners from completing their agriculture programmes at community colleges.

3.1.2.1 AgriSETA and agriculture skills training

The AgriSETA participates in agriculture skills training through its 1712 accredited training providers offering qualifications, from NQF level 1 to NQF level 5 (AgriSETA website, 2020). The SETA indicates that there is adequate provision of agricultural training at lower NQF levels (NQF Levels 1 and 2). The provision of skills at NQF levels 3 and 4 is increasing but the AgriSETA still needs to work to address the skills gaps identified at these levels. These include leadership, supervisory, financial management, general management skills, technical, computer literacy, marketing, communication, and adult education and training.

3.1.2.2 The quality of training

Agricultural Education and Training (AET) plays a major role in training growers, researchers, educators, extension workers and agribusiness managers and employees to make successful contributions. Studies on Agricultural Education and training indicate that many agricultural education curricula have deficiencies because they are unresponsive and adequate to socio-economic, technical, physical and environmental changes in the rural and local sectors (DAFF,2016; Pannel et al., 2017). The tertiary or post-school system is the core of the agricultural education system (AET).

Panel et al (2017) noted that too many institutions focus on academic programmes and too few prepare people for the intermediate and lower levels of skills. Currently, there are just over a million students enrolled in university-level programmes and fewer than that in technical and vocational programmes. While both systems have grown, the largest growth has been in the TVET colleges, where over the past 10 years the student numbers have doubled (DHET, 2020). The growth in TVET offerings has not translated into rapid increase in the numbers of learners enrolling for agriculture related courses.

To address the skills shortages in South Africa, National Qualification Framework (NQF) bounds with qualifications in the field of agriculture. Given the variety of components that are drawn from a broader range of disciplines beyond conventional agricultural focused qualifications. Numerous qualifications and courses are linked to the field of agriculture. To be relevant, agricultural education and training (AET) must focus on building capacities not only for agricultural production but also to equip a broad range of professionals and practitioners with the necessary skills to engage successfully with the key links in the value chain.

3.2 Supply from a Curriculum Perspective

3.2.1 Formal training of Agricultural Extension Officers (AEOs) with regard to curriculum

Agricultural extension is a fundamental aspect in agricultural development in South Africa, especially in rural development. In South Africa, competency-based education (CBE) has recently emerged in the agriculture educational and training system (AgriSETA 2014; Lotz-Sisitka et al., 2021), thus replacing the traditional approach to agricultural extension which focused on the transfer of technologies from researchers to farmers. However, DAFF (2008) has noted that the agriculture curriculum that incorporates CBE focuses mainly on competence development for conventional methods of agriculture, thus neglecting training of extension professionals who are able to manage change in the rapidly changing world. Based on this review, it was recommended that the Agriculture curriculum in South Africa needed to be adjusted and upgraded to be more responsive in addressing the critical challenges of the South African agricultural sector.

“The responsibility of the AEO is knowing how to capacitate farmers, including demonstrating of and bringing the use of new technologies which the farmers have to learn from them, which are adaptable, context specific so that the farmers are able to

use...For the AEO to perform well, being with the farmers always and experiencing their challenges with them will make you understand and be able to transform these farmers' lives. As an AEO you need to know how to assist farmers to overcome the challenges of poverty, food security and climate change.” Lecturer, University of Fort Hare

With this in mind, most institutions in South Africa who train AEO have highlighted that the curriculum is not adequate enough to prepare competent AEO.

“The curriculum is not adequate enough to really prepare competent AEOs that could be able to handle the South African economy and industry. The curriculum is not moving with the time especially to the black farmers as it is still talking about the apartheid era, it does not accommodate all farmers as it is mostly centred on addressing challenges of the resource- poor farmers.”

“The curriculum should talk to the industry, e.g. when it comes to marketing, farmers need to know about the use of ICT where they can use it for marketing their products. If the AEO cannot use these in their own profession and have never been taught about this, it will be difficult to transfer this knowledge to the farmers.”

The University of the Free State is introducing Extension as a course to equip extension professionals who will be able to deal with many challenges such as supporting farmers to adapt to climate change, helping farmers to access high-value markets, organising farmers into groups, and dealing with issues related to natural resource management and marketing. The course includes different modules which are taught at second year (NQF level 6) and third year (NQF level 7). The modules are designed in line with the Global Forum for Rural Advisory Services (GFRAS). Below are examples of two of the modules that are offered at the University:

(i) Extension with the Agricultural Innovation System (Level 6, taught at second year)

The scope of knowledge in this module includes detailed knowledge of the Agricultural Extension disciplines and/or practices, including an understanding of and an ability to apply the key terms, concepts, facts, principles, rules and paradigms of this field, discipline or practice. Knowledge of the Agricultural Extension discipline which relates to Rural Advisory Services and Agricultural Innovation

Systems discourse, and other fields, disciplines or practices. After successful completion of this course, students are expected to:

- a. Understand the extension paradigms, methods, approaches, and tools: (i) with vast knowledge of the history of agricultural extension paradigms, principles, methods, approaches and systems; (ii) with an understanding of pluralism in extension and the need for and methods of coordination and linkages, and be able to consider extension as a profession and extension science

- b. Understand the role of extension in innovation and development through: (i) Understanding the relationship between agricultural extension and innovation systems and (ii) Understanding of the agricultural innovation systems concept; and
- c. Understand the concept of the new extensionist through: (i) introduction to the new extensionist concept and framework, (ii) understanding of what these concepts imply for roles of extension and advisory services within the innovation system.

AEO serve as facilitators or knowledge brokers as they try to get the farmers link to information, markets and other services in order to diversify their farming systems and increase productivity

- (ii) Communication for Innovation (Level 6, taught at second year)

The scope of knowledge in this module includes (i) detailed knowledge of the Communication for Innovation disciplines and/or practices, including an understanding of and an ability to apply the key terms, concepts, facts, principles, rules and paradigms of this field, discipline or practice and (ii) knowledge of how Communication for Innovation relates to Extensions, Rural Advisory Services and Agricultural Innovation Systems discourse, and other related fields, disciplines or practices. After successful completion of this course, students are expected to understand why communication is critical for innovation, understand the different communication models and modes, understand the dynamics of communication and ways of minimizing barriers as well as understanding the principles and methods of knowledge management, learning and sharing. Mostly, students are also expected to have an overall understanding of information and communication technologies (ICTs) and mass media communication, when and how they are appropriate.

“Agricultural communication has not been developed in the AE curriculum. There is a need to repackage the curriculum and include the use of radio in communicating agriculture.”

“Due to lack of the use of ICT in curriculum, the AEO of today may not be able to transfer knowledge to the commercial farmers because these farmers know more, they are the ones who can teach our AEO. They do not have practical experience about farming. Hence the AEO in South Africa feels that the white farmers are arrogant and do not need them to help them. However, it is best that the AEO as students should do professional development tasks with these commercial farmers as their mentors.”

3.2.2 Agricultural Extension curriculum Analysis: A case of two Agricultural Training Institutions (ATIs)

A detailed analysis of the curricula of these two ATIs has shown that they considered different contexts when it comes to courses and programmes which were offered, and the competences aimed for in their students.

The aims of this analysis were mainly to have a breakdown of the curriculum component at each institution and provide rough proportions of how the different components are allocated for each programme, with special attention to agricultural extension. The existing curriculum elements were also identified and they were developed into a list with all the detailed modules provided and the total number of credits for each programme (see Table 3.4).

However, with the consultations with the lecturers at some institutions offering AE, we have noted that it has been difficult to update or change the curriculum to align it more with the current challenges which are faced by the agricultural sector.

“It has been difficult to change the curriculum, this has not been changed ever since I joined the institution in 2012, but curriculum needs to be changed every five years to move with the changing times.”

Furthermore, the curriculum analysis together with information generated from interviews also showed that there is need for further development of curriculum content focusing on Information and Communication Technology (ICT), which is crucial especially for AEO, when they are communicating with the farmers. The lack of ICT in curriculum, especially in public institutions makes the AEO incompetent when dealing with farmers, especially the commercial farmers.

“Due to lack of the use of ICT in curriculum, the AEO of today may not be able to transfer knowledge to the commercial farmers because these farmers know more, they are the ones who can teach our AEO. They (AEO) do not have the practical experience of farming and new technology. Hence the AEO in South Africa feels that the white farmers are arrogant and do not need them to help them. However, it is best that the AEO as students should do professional development tasks with these commercial farmers as their mentors.”

Table 3.4. Curriculum analysis of selected institutions showing courses and modules; with focus on identifying Agricultural Extension skills

Fort Cox College of Agriculture and Forestry: Diploma in Agriculture (NQF Level 06)	
<p>Specialisation in Animal Production. (360 Credits)</p>	<p><u>Compulsory Modules, Level 5, 120 Credits:</u></p> <ul style="list-style-type: none"> • <i>Applied agriculture (88 credits):</i> Basic Scientific Concepts, Agricultural Mathematics, Fieldwork Practical 1, Introduction to Crop Production, Fieldwork Practical 2, Introduction to Agricultural Engineering, Introduction to Animal Production, Animal Anatomy and Physiology) • <i>Extension skills (8 Credits):</i> Agricultural Extension 1 • <i>Agribusiness and marketing skills (16 Credits):</i> Introduction to Agricultural Economics, Farm Accounting • <i>Other (8 Credits):</i> Agricultural seminar <p><u>Compulsory Modules, Level 6, 240 Credits:</u></p> <ul style="list-style-type: none"> • <i>Applied Agriculture (152 Credits):</i> Farm Structures, Animal Nutrition, Poultry Production, Pig Production, Rangeland and Pasture Management, Beef Production, Small Stock Production, Animal Health Management 1, Agro-Processing: Animal, Dairy Production, Animal Health Management II, Agricultural Projects • <i>Extension skills (12 Credits):</i> Agricultural Extension 2 • <i>Business and marketing skills (16 Credits):</i> Entrepreneurship, Business Management • <i>Other (60 Credits):</i> Work-Integrated Learning
<p>Specialisation in Agribusiness. (360 Credits)</p>	<p><u>Compulsory Modules, Level 5, 120 Credits:</u></p> <ul style="list-style-type: none"> • <i>Applied Agriculture (88 Credits):</i> Basic Scientific Concepts, Agricultural Mathematics, Fieldwork Practical 1, Introduction to Crop Production, Fieldwork Practical 2, Introduction to Agricultural Engineering, Introduction to Animal Production, Animal Anatomy and Physiology/Crop Physiology and Ecology • <i>Extension skills (8 Credits):</i> Agricultural Extension 1 • <i>Agribusiness and marketing skills (16 Credits):</i> Introduction to Agricultural Economics, Farm Accounting • <i>Other (8 Credits):</i> Agricultural seminar <p><u>Compulsory Module, Level 6, 240 Credits:</u></p> <ul style="list-style-type: none"> • <i>Applied Agriculture (80 Credits):</i> Field Crop Production, Pig Production/Poultry Production, Agricultural Marketing 2, Agricultural Industry, Vegetable Production, Beef Production/Small Stock Production, Agro-Processing: Crop/Animal • <i>Extension skills (12 Credits):</i> Agricultural Extension 2 • <i>Business and marketing skills (68 Credits):</i> Production Economics, Entrepreneurship, Agricultural Marketing 1, Financial Management, Supply Chain Management, Entrepreneurship Projects, Business Management • <i>Social context (8 Credits):</i> Human Resource Management • <i>Other (72 Credits):</i> Work-Integrated Learning, Project Management

<p>Specialisation in Crop Production.</p> <p>(360 Credits)</p>	<p><u>Compulsory Modules, Level 5, 120 Credits:</u></p> <ul style="list-style-type: none"> • <i>Applied agriculture (88 credits):</i> Basic Scientific Concepts, Agricultural Mathematics, Fieldwork Practical 1, Introduction to Crop Production, Fieldwork Practical 2, Introduction to Agricultural Engineering, Introduction to Animal Production, Crop Physiology and Ecology • <i>Extension skills (8 Credits):</i> Agricultural Extension 1 • <i>Agribusiness and marketing skills (16 Credits):</i> Introduction to Agricultural Economics, Farm Accounting • <i>Other (8 Credits):</i> Agricultural seminar <p><u>Compulsory Modules, Level 6, 240 Credits:</u></p> <ul style="list-style-type: none"> • <i>Applied Agriculture (136 Credits):</i> Farm Structures, Fruit Production 1, Field Crop Production, Crop Protection, Soil Fertility and Plant Nutrition, Fruit Production II, Vegetable Production, Irrigation, Soil and Water Conservation, Agro-processing: Crop, Farm Mechanisation, Land Use Planning • <i>Extension skills (12 Credits):</i> Agricultural Extension 2 • <i>Business and marketing skills (16 Credits):</i> Entrepreneurship, Business Management • <i>Other (76 Credits):</i> Agricultural Projects, Work-Integrated Learning
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<p>University of Mpumalanga</p>	
<p>Advanced Diploma in Agriculture in Agricultural Extension</p> <p>NQF Level 07</p>	<p><u>Compulsory modules (120 Credits).</u></p> <ul style="list-style-type: none"> • <i>Extension skills (90 Credits):</i> Extension theory and policy context, Planning extension programmes and projects, Extension experiential learning • <i>Other (30 Credits):</i> Principles and practices of management for development, Strategic Management
<p>Bachelor of Agriculture in Agricultural Extension and Rural Resource Management</p> <p>NQF Level 07 (384 Credits)</p>	<p><u>Modules at NQF Level 5 (96 Credits):</u></p> <ul style="list-style-type: none"> • <i>Applied agriculture (48 credits):</i> Farming Systems, Farm Infrastructure, Agricultural Production • <i>Business and marketing skills (16 Credits):</i> Production Economics and Marketing • <i>Other (32 Credits):</i> Natural Resource Identification, Impact on Natural

<p>3 years</p>	<p><u>Modules at NQF Level 6 (160 Credits):</u></p> <ul style="list-style-type: none"> • <i>Applied agriculture (48 credits):</i> Beef Production, FieldCrop Production, Vegetable Production • <i>Extension Skills (32 Credits):</i> Extension Methods,Extension Practice • <i>Business and marketing skills (40 Credits):</i> Rural Wealth Creation, Rural Economic Systems, Farm BusinessManagement • <i>Other (40 Credits):</i> Forage Management, Infrastructureand Machinery Development, Farm Development <p><u>Modules at NQF Level 7 (128 Credits):</u></p> <ul style="list-style-type: none"> • <i>Extension Skills (64 Credits):</i> Designing Extension Projects, Participatory Extension, Extension Placement • <i>Business and marketing skills (32 Credits):</i> FarmFinance • <i>Other (32 credits):</i> Land Use Planning
<p>Bachelor of Agriculture Honours in Agricultural Extension and Rural Resource Management</p> <p>NQF Level 08 (120 Credits)</p> <p>1 year</p>	<p><u>Compulsory Modules at NQF Level 8 (120 Credits):</u></p> <ul style="list-style-type: none"> • <i>Extension Skills (60 Credits):</i> Extension research project, Advanced extension theory and practice • <i>Social context (30 credits):</i> Rural development placement • <i>Other skills (60 credits):</i> Systems thinking foundations, Rural development placement, Project design and management
<p>Bachelor of Science in Agriculture</p> <p>NQF Level 08 (480 credits)</p> <p>4 years</p>	<p><u>Compulsory Modules, Level 5: 120 Credits:</u></p> <ul style="list-style-type: none"> • <i>Applied agriculture (90 credits):</i> South African Agriculture, Introduction to Biology, Introduction to Chemistry, Science for Sustainable Agriculture, Biology inthe environment, Environmental Science and Systems • <i>Other (30 Credits):</i> Numerical and academic literacy, Enduser computing <p><u>Compulsory Modules, Level 6: 90 Credits:</u></p> <ul style="list-style-type: none"> • <i>Applied agriculture (75 credits):</i> Principles of PlantProduction, Plant Production Practices, Large Stock

Production, Small Stock Production, Soil Science for Agriculture

- ***Business and marketing skills (15 Credits):***
Agricultural Business 2

Elective Modules, Level 6 (30 Credits for each module):

- ***Applied agriculture:*** Entomology, Ecology
- ***Extension Skills:*** Agricultural Extension
- ***Other:*** Integrative Environmental Science, Water Management

Compulsory Modules, Level 7: 90 Credits:

- ***Applied agriculture (75 credits):*** Advanced Small Stock Production, Advanced Plant Production, Advanced Large Stock Production, Plant Breeding, Fruit production
- ***Other (15 Credits):*** Grassland Science

Elective Modules, Level 7 (30 Credits for each module):

- ***Applied agriculture:*** Agricultural Entomology
- ***Extension Skills:*** Agricultural Extension
- ***Business and marketing skills:*** Advanced Agricultural Business
- ***Other:*** Water Science, Advanced Ecology

Compulsory Modules, Level 8: 120 Credits (students choose one stream):

Compulsory Modules (90 Credits):

(i) Agricultural Science stream

- ***Applied agriculture (60 Credits):*** Research-led Advanced Seed Technology, Research-led Advanced Horticultural Production, Research-led Advanced Fruit Production, Research-led Advanced Animal Nutrition
- ***Other (30 Credits):*** Agricultural Research Project

(ii) Agricultural Business stream:

- ***Business and marketing skills (45 Credits):*** Research-led Agricultural Business Case Studies, Research-led, Agribusiness Finance and Marketing, Research-led Agribusiness Entrepreneurship
- ***Other (45 Credits):*** Agricultural Research Project, Research-led Agricultural Development

Elective Modules for both streams (30 Credits)
(students choose 2 modules, each is 15 Credits):

- ***Applied agriculture:*** Advanced Agricultural Entomology, Ecology, Agriculture and Conservation, Post-Harvest Technology,
- ***Extension Skills:*** Advanced Agricultural Extension
- ***Other skills:*** Advanced Water Management, Agricultural Policy

From the above analysis, the qualifications offered at the institutions aim to train and equip agricultural extension practitioners with the skills, knowledge and attitudes needed to contribute to building the capacity of farmers to innovate and to engage in market-orientated sustainable agricultural production, diversification of products and value adding; to improve their household livelihoods and to contribute to strengthening the rural economy. The curriculum is structured in equipping students with knowledge and skills in applied agriculture with focus on understanding the methods and principles of analysis and applying the relevant tools, agricultural extension with focus on theory and policy context, planning and practice and social skills. The curriculum is also designed to equip agricultural practitioners with skills to work in the agricultural industry, with strong focus on agricultural production, human development, entrepreneurship and agricultural economics and agribusiness.

Bachelor of Agriculture (B Agric) graduates will contribute to improving and enhancing the quality and effectiveness of agricultural extension services. They will help meet the demand for professionals who can lead and manage agricultural extension through the complex world of agricultural and rural transformation. As identified in the National Strategy for Agriculture the National Strategy for Agricultural Education and Training (AET) and the Norms and Standards for Agricultural Extension, there is an urgent need for extension practitioners who are appropriately trained to meet the demands highlighted by agricultural policy. The curriculum is structured across five learning areas: foundational science, agricultural production science, agricultural business, natural resource management, and agricultural extension (with an emphasis on innovation). Each of these provides grounding in areas critical to sustainable agricultural production within a systems framework. The qualification enables learners to develop more than just science knowledge and skills but to enable them to develop a range of social skills as well. (University of Mpumalanga)

However, skills to prepare the AEO to understand and work within South Africa's changing agricultural landscape, including innovative skills to deal with issues of climate change and sustainable agriculture are not studied in detail (if there) or are lacking in other courses. Other skills that are evident in the curricula studied include project planning and management, use of post-harvest technologies and social skills are evident in the modules such as Extension Theory

and practice. Skills in ICT are lacking as was also highlighted from the interviews conducted in this project.

Overall, the detailed analysis of the programmes offered at institutions has shown that agricultural extension is not regarded as a major course at most institutions. For example, an analysis shown on table 3.2 above highlights that applied agriculture skills have more credit than any other, with extension skills ranging from 75 credits for a four year programme with 480 credits (16 %) and about 96 credits for a three year programme with 384 credits (25 %). An exception is the Bachelor of Agriculture Honours in Agricultural Extension and Rural Resource Management from the University of Mpumalanga which offers 50 % of its credits (60 credits) to agricultural extension and a quarter to social skills (30 credits). However, these modules mostly focus on theory and practice and an extension research project, without mention of ICT and other innovations.

However, although most institutions have outdated curriculum with relation to agricultural extension, some institutions are moving ahead to equip their scholars with skills aligned to the most current demands. For example, the University of Fort Hare has added into their teaching some innovative ways of transferring knowledge to farmers through their students' mentorship programme, through radio communication as well as through drama.

“The use of radio for communication of agricultural activities and the black imaging farmers who are now teaming up with the white commercial farmers to be capacitated in growing knowledge in agriculture is one example of knowledge transfer. The commercial farmers become their (black farmers) mentor. Also, as AEOs (students) are learning, they also need mentorship from the successful commercial farmers for them to be most relevant as they will get real practical knowledge.”

“At Fort Hare, students do a project where they visit a farm, observe challenges, come back and formulate solutions where they would go back to the farm and apply their technology. They will have to work with the farmers for a period of six weeks as they apply their technology to overcome the challenges. This capacitate students as they will be able to practically deal with the real challenges that farmers face.”

4. CHAPTER 4: ANALYSIS OF THE DEMAND FOR AGRICULTURAL EXTENSION OFFICERS

4.1 An Overview of the Labour Market and Demand for AEOs

The National Development Plan (NDP, 2012) indicates that successful land reform, infrastructure development, and job creation and poverty alleviation would integrate rural areas into the wider economy. The NDP calls for substantial expansion of irrigated agriculture, dry-land production, the promotion of agro-processing/agro-industry and improvement of agricultural development and land management in the former homeland areas. The plan emphasises smallholder farmers' capacity- building capacity in partnership with established agricultural industries and farmers.

Education and training are required in production, farm management, business management, resourcemanagement and entrepreneurship and in extension and agricultural development for those responsible for implementing the programmes in the field. The Agri-SETA (2020) also suggests the need to top up managerial capacity and extension capacity to achieve successful land reform. There is therefore a need to increase the number of extension officers to facilitate skills development among the farmers in South Africa.

4.1.1 Number of extension officers required

The Norms and Standards for Extension and Advisory Services in Extension report of 2005 noted that South Africa had only 2210 extensionists and envisaged the number of governmental extensionists to 5500 extensionists to meet the demand of agriculture and rural development (Department of Agriculture, 2005). However, Williams et al (2008) noted that in June 2008, South Africa had 2092 extension staff. This shows that there has been a decline in the number of officers since 2005. Currently, the Director of National Extension Reform in South Africa indicated in an Interview that the ratio of 1 extension officer to a farmer is 1 as to 1053 farmers (Interviewed by Mushangai, at Johannesburg, 07/06/2021). He indicated that there is a need to employ about 10 000 to achieve the ratio of 1 extension officer to 250 farmers as advocated for in the Norms and Standards document (Interviewed by Mushangai, at Johannesburg, 07/06/2021). An analysis of occupational shortages and skills gaps reveals the extent of the challenge in the supply of extension officers in South Africa.

4.1.2 Occupational shortages and skills gaps

Small-scale Farmers Hard-To-Fill Vacancies (AgriSETA SSP, 2020)

Many occupational and skills gaps have been identified in the agriculture sector, hence the demand for these skills. The AgriSETA (2020) noted a shortage of health and safety technicians, artificial insemination specialists, agricultural produce marketing representatives, farm and cellars technicians and nutritionists. The shortage of health and safety is because of the lack of suitably qualified candidates in rural areas with a National Diploma. There is a need for skills Programmes, learnerships, and bursaries to address this. Artificial insemination

specialists are too expensive to hire (AgriSETA, 2020). There is a need for mentorship programmes to address the shortage of agricultural produce marketing representatives. As for farm and cellar technicians, there is a lack of candidates with technical skills in vineyards and cellars for wine production. The absence of nutritionists in the sector is linked to low wages as most of the producers cannot afford to pay high salaries. Thus, some of the reasons for vacancies being hard to fill are non-skill related while a few are skills related. Some vacancies are hard to fill due to the entities not generating enough income to cover wages for employees holding higher education qualifications, hence the need for government salaried extension officers. In the hard to fill vacancies, skills programmes, learnerships, mentorships and bursaries are required to address the gaps. In summary, the hard to fill vacancies regarding small scale farmers development are because of budgetary constraints; a lack of suitably qualified and experienced specialists; skills poaching in the industry; ageing of qualified specialists etc (AgriSETA, 2020).

Hard-To-Fill Vacancies for Commercial Entities (AgriSETA, 2020)

Regarding commercial entities the AgriSETA, (2020) identified a shortfall of 358 Crop Production Farm Workers, 150 Mixed crop and livestock Farm Workers, 72 Agricultural-Farm Managers[1] requiring a National Certificate in Agricultural Management (NQF 5) or National Diploma in Agricultural Management (NQF 6), 42 Mixed Crop Farm Production Managers, 27 Agricultural / Horticultural Produce Inspectors, 21 Agricultural Scientists[2] requiring a Bachelor of Science in Agriculture (Livestock Science and Zoology)-NQF 7, Agricultural technicians[3] requiring a National Certificate in Agriculture (NQ5) or a National Certificate (Vocational NQ6). The AgriSETA recommends for qualified candidates to enrol on workplace-based learning (WIL) where there is an integration of academic and technical skills.

The agriculture sector also experiences a shortage of Environmental policy and planners Agriculture Consultants, Agricultural Scientists, Forest Scientists, Agricultural Engineers, Agricultural Engineering Technologists, Environmental Education Managers; Environmental Engineers, Environmental Impact & Restoration Analysts, Environmental Science Technician, Veterinary Pathologists, Life Science Technicians, Technical Service Advisors, Chief Information Officers, Conflict Resolution Practitioners, Agriculture Mentors, Negotiation Finance Brokers, Livestock Inspectors, and pest control supervisors (LMIP, 2018). The list is long, requiring collaboration and concerted effort among stakeholders to address the gaps.

Further analysis indicates that for commercial farmers the majority of the skills gaps are in the managerial, professional, technicians and associate professionals and clerical workers' occupational levels whereas the skills gaps for small-scale farmers were mostly soft skills including communication, conflict management and production coordinating skills. The differentiated skills needs call for extension cadres equipped with a mix of skills in working with both small and big businesses to address their differentiated needs. Worthy of note is that, the shortage of skills in this sector is less when compared with other sectors. For instance, the average intensity of shortages in the mining sector is more than three times as large as in the agriculture sector, and more than twice as large as in the safety and security sector.

4.2 Competences, Occupational Role(s) and Workstream

The government is responsible for forecasting, planning and funding the implementation of extension skills programmes with a focus on addressing various challenges to agriculture and rural development. The skills acquired should enable extension officers to respond effectively to current challenges concerning technological changes, climate change, and land and agrarian reform. The nature of skills and competencies by extension officers are also defined by the demand of employers on the job market. Some of the job adverts have a productivist focus on enabling farmers to increase agricultural production with the officer supposed to be armed 'with the latest techniques and information related to agriculture and relay this information to farmers and agricultural businesses.' However, some of the job adverts consider all of Shaxon et al., 2011 dimensions of an extension officer as an information intermediary, knowledge translator, knowledge broker and innovation broker. In this regard, the officers are also supposed to 'provide consultation with farmers and agricultural businesses and to give talks, guidance and actual demonstration on the latest technologies related to agriculture and on how they can take advantage of such technologies.' <https://za.knownjobs.com/job/agricultura-field-extension-officer-ee-vacancy-farm-manager-sa-8dd1aace8d93018b/>. They also attend seminars and work with other experts in agriculture to learn more or even develop new methods that could advance production.

4.2.1 Job descriptions from job adverts

The job descriptions vary greatly depending on the mandate of the organisation involved and on the nature of the intervention muted. Some of the jobs require extension officers to:

- Implement efficient methods and utilization of resources like soil, water, veld money, etc.
- Provide technical support for organized agriculture and other agricultural stakeholders and also assist with planning, advice and aftercare. Promote sustainable production of Agricultural products.
- To promote sustainable development in the agricultural sector through the application of the appropriate extension principles and methods.
- Determine the research needs of the area.
- Establish and enhance the relationship with clients and (internal and external) stakeholders.
- Provide continuous support to ensure sustained production and improvement.
- Implement government support programmes such as CASP, Letsema, land care etc.
- Keep up to date with the applicable prescripts, policies, procedures, technologies and new developments to be able to render efficient and effective extension services.

Most of the advertised vacancies require demonstration of farming/production methods, presenting and organizing farmer days, information sessions, constant farm visits for impact assessment, sourcing inputs from specialists, and providing scientist and technical inputs.

4.2.2 The educational requirements from the job adverts

Analysis of the Extension Occupational Job Profiles from job adverts yielded a variety of extension job descriptions, qualifications, skills and competencies currently required for one to be employed as an extension officer. These qualifications, skills and competencies also define one's competitiveness in the job market. The qualifications required for extension services as outlined in the job adverts range from a matric certificate plus NQF 6 in Agriculture Diploma; NQF level 7/four year's qualification in Agriculture; B Tech or Agricultural Degree. In some cases, diplomas and degrees in engineering, food science or finance/commerce are required. Foreign nationals are requested to obtain SAQA accreditation of their qualifications. In some cases, SACE registration and evidence of having completed a facilitation and assessors' course.

4.2.3 Skills and competencies

The job adverts show that the skills required for extension officers now extend beyond a focus on agriculture. Box 1 below shows the range of skills and competencies currently required of an extension officer in South Africa.

Table 4.1. Skills and Competences sought from agricultural extension officers

<i>Skills</i>	<i>Competences</i>
Computer skills, Communication/presentation skills, Methodology and Project Planning, Financial management, Strong administration skills, problem-solving skills, Interpersonal skills, Report writing skills, analytical skills, Food safety standards & quality control Specific regional production planning and tracking, ability to manage multiple tasks and deliver projects and programmes through to completion, Adaptability changing priorities and working calmly.	Knowledge of Agriculture Extension, People management, Change management, Conflict management, Customer focus and responsiveness, planning and organising, A valid driver's license (Code EB), Self-management, ability to work with persons with impairments, positively and effectively under pressure, working independently and take ownership of a task. Knowledge of Public Service Legislations, IDPS, PGDS and CAPS
<p>https://za.knownjobs.com/job/agricultura-field-extension-officer-ee-vacancy-farm-manager-sa-8dd1aace8d93018b/</p> <p>https://www.joblife.co.za/viewjob/govt_jobs_extension_assistant_opportunities_19_vacancies-1253105503</p> <p>https://www.joblife.co.za/viewjob/agricultural_advisor_extension_services_x_13_positions-125309142 https://www.joblife.co.za/viewjob/agricultural_facilitator-2254324457</p> <p>https://za.knownjobs.com/job/agriculture-extension-officers-vacancy-smartagriot-pty-ltd-00b558f30ea85bd4/</p> <p>https://www.joblife.co.za/viewjob/agricultural_development_technician_x_10_positions-1253209046</p> <p>https://www.pnet.co.za/jobs--Technical-Advisor-Cape-Town-Peoplefinder-Career-Placements--3279185-inline.html?suid=670e4436-6ff9-4d70-b6a9-bb008e8d0682&rltr=3_3_25_mb_m_0_0_0</p>	

[https://www.pnet.co.za/jobs--Agricultural-Advisor-Nelspruit-Peoplefinder-Career-Placements--3281788-inline.html?suid=670e4436-6ff9-4d70-b6a9-bb008e8d0682&rltr=25 25 25 mb m 0 0 0](https://www.pnet.co.za/jobs--Agricultural-Advisor-Nelspruit-Peoplefinder-Career-Placements--3281788-inline.html?suid=670e4436-6ff9-4d70-b6a9-bb008e8d0682&rltr=25%2025%20mb%20m%200%200)

4.3 Knowledge Currently Being Shared into the Sector by AEOs

From the analysis of programmes offered at universities, colleges and the AgriSETA SSPs and skills support programmes, most of the programmes are demand focused with a desire to equip farmers with skills to achieve government programmes and to enable them to respond effectively to rapid changes in technology, climate and the political environment. However, the programmes though demand focused some aspects are related to information technologies, management business skills are not fully grounded in extension curriculums at universities and colleges. Most of the job adverts show that the central aspects of extension concerning productivity have remained. Nonetheless, the demands have been extended to include aspects that are not mainly addressed by extension skills programmes. Some of the advertised jobs required a thorough understanding of life sciences and environmental sciences. The requirements have become broad that no extension curriculum can address the variety of issues raised. There is a need for refresher courses to be provided by the employer for it would be impossible for government universities and colleges to cover all these issues.

Further, there is the issue that some of the job adverts now require officers registered with SACE and certified as facilitators and assessors. Most of the extension officers coming from colleges are not equipped to facilitate. Even though this is a policy focus to enable officers to act as brokers, they are not properly trained to do this. Thus, most of the knowledge being transferred is bookish, codified knowledge not knowledge produced with farmers taking into consideration traditional knowledge systems.

Extension officers are not adept with information technologies, and as a result, the mode of extension has remained at the level of face-to-face transmission. This has been a challenge especially with the ongoing pandemic that has limited the movement of people. Even if the extension officers were adept with information technologies, most of the rural people whom they supported do not have and some cannot operate these technologies.

Further, most of the officers are not articulate when it comes to current challenges relating to climate change and other related concepts such as conservation agriculture. There is a need for these issues to be emphasised in extension curriculum to respond effectively to these emerging issues. The challenge again here may be related to difficulties in learning by aging officers as noted by a senior official in the Limpopo province extension department.

4.4 Gaps Between Supply And Demand

An analysis seems to point towards an adequate supply. The National Director of Extension reform indicated the unavailability of a budget to employ more officers is that challenge. This

may be taken to mean that there are qualified officers in the market who are not employed because of the lack of funds. The major challenge pertains to the quality of the training. There is a need for extension methodologies that focus on farmer empowerment and not only on crops and productivity. New approaches are required for officers to make use of traditional knowledge systems. Lastly the curriculum should enable extension officers to employ adaptive, participatory and integrated approach to research, extension and training. Officers should be equipped to understand the complex nature of managing multiple resources including the social dimensions of a community. Some of the requirements in Job adverts cannot be all covered in an extension curriculum. There is therefore a requirement for in-service training with a strong emphasis on practical implementation and participatory action research.

5. SUMMARY AND FUTURES PERSPECTIVE ON AEOs

5.1 Summary of the Status Quo from a RAELL Perspective

The farmers indicated that agricultural extension officers are still relevant and recognised that extension officers are core to learning and knowledge transfer to farmers.

Farmers have many expectations of Agricultural extension officers as facilitators of social learning and disseminate knowledge about emerging issues, especially climate change. Some farmers indicated that most extension officers have “limited” indigenous knowledge of farming. Those who farm organically indicated that among the roles of an extension officer is to advance “indigenous knowledge” by providing farmers with “technical information and support” to assist them in controlling “pests” using natural methods.

“Extension officers should be giving technical support like advising the farmers, especially with climate change, what crops should be planted, when, and they should be advising farmers on things to use for rainwater harvesting, to save water so that then they can be able, even in their gardens to produce even during drought. Extension officers are supposed to be like even advising the farmers on improved traditional seeds...not GMOs”-Organic Farmer

Farmers also expressed their expectation of agricultural extension officers to function as “researchers” of new information about farming and provide this knowledge to the farmers. According to one farmer, extension officers need to assist them with “on-site support and coaching “ so they [farmers] can learn how to do practical farming such as how to do intercropping to increase “soil nitrogen”, how to measure “soil temperature” and methods of “suppressing weeds using ground covers”. Many farmers expressed the need for extension officers to use demonstration farms to “impart skills to farmers practically on- site” to learn about farming practices such as “pollination” in their gardens.

However, farmers' views on the role of extension officers in knowledge sharing about the use of synthetic chemicals such as fertilisers, pesticides, and herbicides on farms. Organic farmers detest the idea of extension officers acting as “agents of multinational corporations” to impose the use of pesticides in their gardens “. Instead, farmers prefer extension officers to “advise on what the farmers ask them for help” but not to impose their way of farming. In contrast, farmers with expansive farms indicated that it is plausible for instance to use “pesticides” [on pests] and “other chemicals” to control weeds. One farmer stated that it is “not possible to weed a large farm like ours with hands” since it would be “financially costly”.

“Our extension officer comes here twice a week and advises me on which pesticides I must use, if he finds something wrong. He even comes and inspects my garden when I am not there and calls me to tell me what chemicals to use on that particular problem.... He is hands-on.” Small-scale farmer

On the other hand, some farmers perceive that there are some knowledge gaps in the study

curriculum used to teach extension officers in agricultural colleges especially in aspects related to indigenous farming practices such as agroecology. One farmer stated that when some extension officers get to the field, they show a limited grasp of “indigenous farming knowledge” and practices.

“The challenge they are facing is that they do not know some things about agroecology, and because they are from the college, maybe they never learn anything talking about agroecology. But they don’t admit that”- Farmer

5.2 Future Perspectives

5.2.1 Farmers’ perspective

For the agricultural extension to respond to the farmer challenges in future, farmers indicated the need for extension officers to “upgrade” themselves by learning further about the emerging challenges of climate change and that the government [Department of Agriculture] needs to support them to achieve this.

“Maybe they also could do the online courses, the one that is done by Rhodes and the Water Research Commission on rainwater harvesting. Yeah, also, they could also update themselves and do insights training if then the government cannot send them on sabbatical leave for organic farming and agroecology, then they should also take the initiative themselves and upgrade themselves and study climate-smart agriculture. Things like that.” Farmer

Farmers showed that moving to the future, the agricultural extension officers need to learn about “climate change mitigation and traditional indigenous knowledge system” and have a mindset change about the environment and climate change. Others mentioned that agricultural colleges and universities need to teach agricultural extension students about the new challenges to farming, such as “climate change” and to focus on “changing the mindset of students” to know that there is a need to “care and protect the earth”.

“if they continue with the industrial agriculture that they were taught about, it’s not going to solve any problems instead, even the oceans now are being depleted, the fish in the sea, they are dying, the environment and yeah, it’s global warming is upon us, because of the industrial agriculture that they are being taught and exposed to, it’s also a mindset in reality. They should see the reality now, that is really they need to change. -farmer

According to one farmer, extension officers need to assist them with “on-site support and coaching “ so they [farmers] can learn how to do practical farming such as how to do intercropping to increase “soil nitrogen”, how to measure “soil temperature” and methods of “suppressing weeds using groundcovers”. Many farmers expressed the need for extension officers to use demonstration farms to “impart skills to farmers practically on-site” to learn about farming practices such as “pollination” in their gardens.

5.2.2 AEOs' perspective

Agricultural extension officers (AEOs) in South Africa recognise their role as intermediaries between research and farmers. Shaxon et al (2011) elaborates the role of agricultural extension officers that has evolved overtime to being information intermediaries, knowledge translators, knowledge brokers and innovation brokers.

Extension officers indicated that their role has evolved and continues to evolve as new challenges emerge such as climate change and new technologies. Most of the extension officers indicated that they still lack the training and skills to cope with the changing working conditions due to climate change. Officers indicated the need to get trained on issues including climate change and using new technologies such as phone applications and to perform duties including “early warnings” to farmers “because the climate has changed”. They also expressed the need to review the current curricula used to train extension officers regularly to ensure that the curriculum responds to the current and future challenges farmers face. Issues such as “Climate change” and “agricultural marketing” are some of the main topics extension officers want included in the learning curriculum of officers. Extension officers were very concerned that farmers are slowly shifting from utilising the services of extension officers such as knowledge brokers and innovation brokers to seeking funding for farmers which is not their main role.

5.2.3 ATIs' perspective

The agricultural sector faces a lot of challenges in keeping pace with the rapidly changing environment; including increasing population, climate change and the use of new technologies in agriculture. The demand for agricultural information and advisory services is likely to increase in the near future, especially in rural areas and farmers will be expected to become more efficient and specialized. There is a need to also recognise the indigenous/local farming systems and know the agricultural information which is needed to support these farming systems. For AEOs to recognise this, they need to work jointly with the farmers as they come up with new technologies and adaptation processes of these as well as monitoring and evaluation of what works and what needs improvements. Therefore, the curriculum of AEOs need to include these aspects when they do their projects. In this case, with the help of AEOs, the farmers become experimenters, developers, and adapters of technology and AEOs being the communicators of this information to other local farmers. Therefore, there is a need for investment in ICT and media technology (e.g. WhatsApp and Facebook) in extension and this has to be offered at ATIs as compulsory modules. The inclusion of information technology in the AEOs' curriculum including telecommunication and computer-based IT is crucial in the agricultural sector. This helps in bringing new information services especially in rural areas (e.g. through local radio) where farmers will have control over a lot of information being shared and are able to make decisions. Some of the above-mentioned ICT and media technologies were implemented successfully in the Amanzi for Food project in South Africa (Lotz-Sisitka et al., 2021), and hence can be used for curriculum innovations for AEOs. Other suggestions from ATI lecturers include involving Arts skills in teaching AEOs which can be presented to farmers and relevant stakeholders in the field of agriculture.

“Other ways we use to teach AEOs and disseminate information is through Agri-drama

and Agri-tainment, where students are given a technology on different agricultural fields to learn and they have to come up with a story/play e.g. on crop production using the technology which can last for say 15 minutes.”

5.2.4 Policy makers’ perspective

There is a mismatch between policy formulation and implementation, and the latter is needed. Currently, because of the lack of policy implementation, there is a dissonance in what extension officers say they do and what they do. There are challenges to achieving this. The first relates to the lack of a budget to employ more officers to achieve the policy requirements of the ratio of 1 officer to 250 farmers. Currently, extension officers are overburdened with the current ratio of extension officers to farmers at 1 to 1053 farmers (National Director of Extension, Interviewed by Dandira Mushangai, Johannesburg, June 2021). This may affect extension methodologies employed.

Second, the Provincial Director of Limpopo province noted a large number of old extension officers whom she said are difficult to change and learn about information technologies and new extension methodologies to change their practices and adopt new understanding (Interviewed by Mushangai, Johannesburg, June 2021). These extension officers have to be retrained to improve efficiency.

5.2.5 Research community perspective

Extension officers need training information technologies. Information technologies. These technological advances such as networked computer systems are impacting production systems regarding the process, product and functional innovations. Global pandemics such as the COVID 19 provide a fertile environment for the supersession of face-to-face approaches to extension by e- platforms. Information technologies when employed correctly enhances the ability to communicate information, work in teams, lead, solve problems, and self-organise. Currently, in South Africa only specialist agricultural consultants have these skills while generalist government extensionists lack these skills. The ICT skills will facilitate extensive networks enabling extension officers to tap into far-away markets to bring in the latest knowledge and adapt to local environments.

There is also a need for an expansive extension methodology focused on interacting and coproduction of knowledge. Extension officers would benefit if they work with anthropologists and sociologists in this.

Further, there is also a need for a standardised extension curriculum across institutions of education in South Africa. This would ensure that officers trained at different institutions are exposed to similar knowledge and standards. This will be resolving the problem whereby different officers may deliver contradictory messages to farmers. Moreover, knowledge of conservation, sustainability and gender mainstreaming have to be mainstreamed in the extension curriculum.

5.2.6 Agricultural industry perspective

The industry noted changes within the current environment related to climate change and rapid technological changes. Within this frame the industry is interested in an extension officer with an understanding of these challenges and capable of working with the farmers in resolving them. The industry would like the higher education institutions to produce an officer who is capable of employing media and ICT technologies for speed in the dissemination of knowledge in addressing challenges in the sector.

5.3 RAELL OCCUPATIONAL ROLE PROFILE

Table 5.1. Occupational role profile of qualifications, skills and competencies sought in AEOs

A competent AEO needs to <i>know that</i> ... (list the things that an AEO needs to know e.g. about farming, climate change, biosciences etc. These can be separated into different areas of focus)		
AEO knowledge and learning role: Know that	Elaboration	Educational underpinning
Food safety standards & quality control	One of the knowledge requirements for an extension officer	agricultural engineering
climate change while and environmental conservation	Minimum knowledge requirement, qualification open to all science fields	Bachelor of Science degree in any field
A competent AEO needs to <i>know how to</i> ... (list the things that an AEO needs to be able to do – this can be separated into agricultural skills, facilitation skills)		
AEO knowledge and learning Role: Know how	Elaboration	Educational underpinning
vegetable gardening, livestock management, agroforestry, and nutrition education	Professional work experience in a field related to the project sector	Bachelor of Arts/Bachelor of Science degree in any field
have experience in sub-tropical fruit or nut production	This knowledge gives a candidate an added advantage	Have a BSc (Agric) in Horticulture
Knowledge of Agriculture Extension	organisations require different qualifications (NGOs vs government)	Matric certificate plus a relevant NQF level 7/four year's qualification in Agriculture.
Multitasking, Presentation skills	Candidate has the ability to engage farmers and other stakeholders and can multitask	Bachelor's degree related to agriculture
Computer, financial management skills		A relevant 3-year qualification in Agriculture or an equivalent

A competent AEO needs to <i>embody</i> ... (list the values, attitudes and skills (incl. interpersonal, learning and social skills) necessary to perform the role)		
AEO knowledge and learning	Elaboration	Educational underpinning
Role: Embody		
Customer focus and Responsiveness	Skills and competency requirement and minimum qualification	Bachelor's degree related to agriculture
ability to work with persons with impairments		
Positively and effectively working under pressure		
Conflict management		
Change management,		
Planning and organising		

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