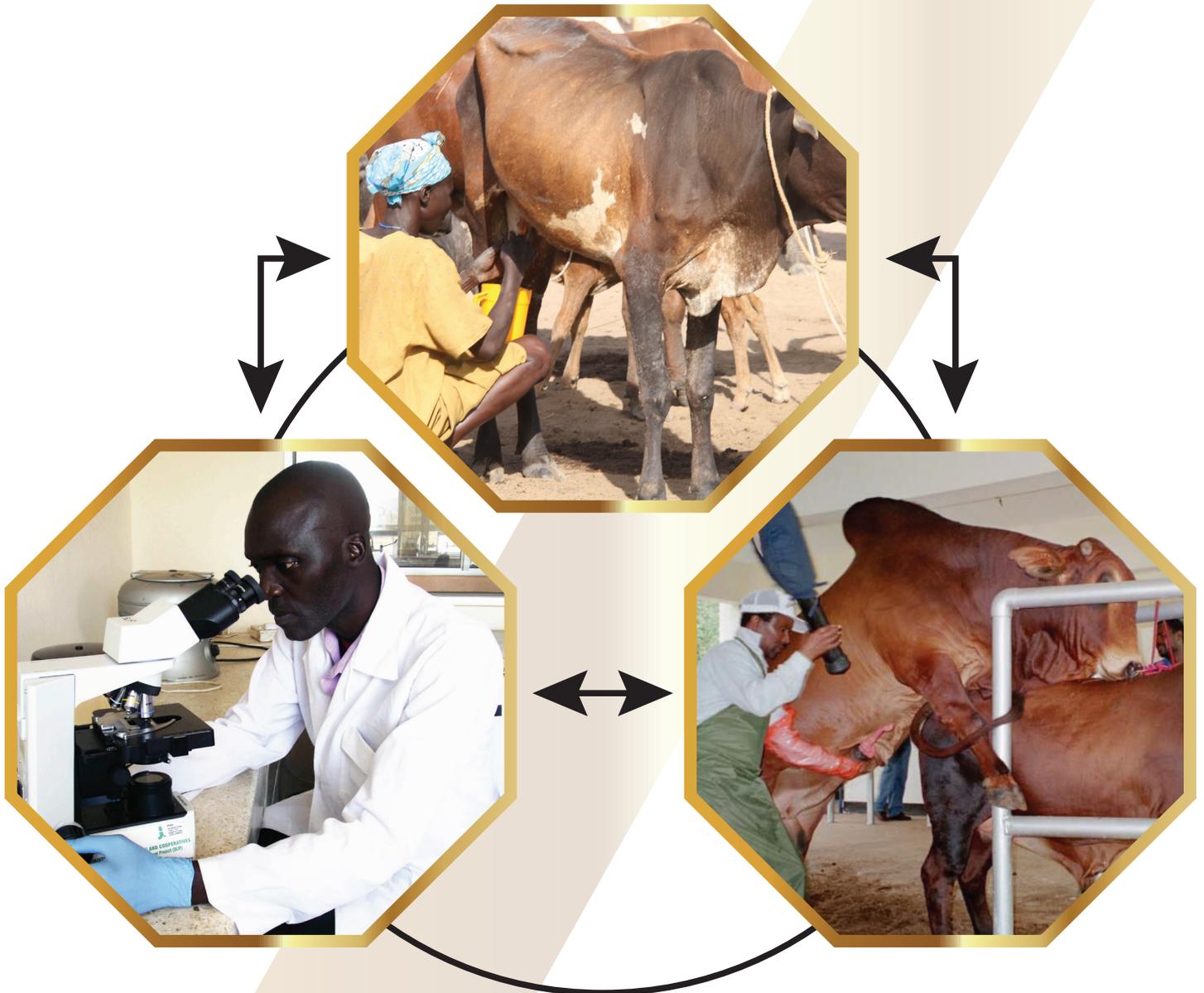




AFRICAN UNION
INTERAFRICAN BUREAU
FOR ANIMAL RESOURCES



**Continental Strategy to
Strengthen Research-Extension-Farmer Inputs
Linkage System (REFILS) for
Increased Technology Development, Transfer and
Uptake in Africa**

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Acronyms

AGRITEX	Department of Agricultural Technical and Extension Services
AnGR	Animal Genetic Resources
ASF	Animal Source Foods
AU	African Union
AUC	African Union Commission
AU-IBAR	African Union - InterAfrican Bureau for Animal Resources
CAADP	Comprehensive Africa Agriculture Development Programme
CBO	Community Based Organizations
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
COMESA	Common Market for Eastern and Southern Africa
DREA	Department of Rural Economy and Agriculture
EAC	East African Community
ECOWAS	Economic Community of West African States
FAO	Food and Agricultural Organization
ICT	Information and Communications Technology
ILRI	International Livestock Research Institute
LiDeSA	Livestock Development Strategy for Africa
MS	Member States
NARES	National Research and Extension Services
NGO	Non-Governmental Organizations
NSA	Non State Actors
PPP	Public Private Partnerships
REC	Regional Economic Community
REFILS	Research-Extension-Farmer Inputs Linkage System
SADC	Southern African Development Community
STISA	Science, Technology and Innovation Strategy for Africa
UN	United Nations
USD	United States Dollars

Executive Summary

The African continent has made its intention to prioritise agriculture as the driver of economic growth very clear through the Maputo and Malabo Declarations which led to development of guiding documents like the Comprehensive African Agricultural Development Programme (CAADP), and more specifically the Livestock Development Strategy for Africa (LiDeSA). One of the key themes of these declarations is the stimulation of innovation, development of technology, its transfer using various extension methods and eventually its adoption by the target farmers. Research-Extension-Farmer Inputs Linkage Systems (REFILS) has been identified as a tool that can be used to accomplish that goal. This tool brings together all the key stakeholders in the agricultural sector (research, extension, farmers, development partners and the private sector) for the effective management of technology development and research, extension delivery and adoption by the farmers for sustainable agricultural development. The status of REFILS on the African continent is not properly documented and understood.

This study was undertaken to review the status of REFILS in Africa and examine any models that may exist in Member States or at regional level for adoption and/or adaptation, evaluate the development, uptake and utilization processes of technologies and innovations specific to animal resources by all key actors at national and regional level and determine how these stakeholders interact in this process, identify for upscaling Best Practises and Lessons Learnt from the REFILS experiences with special focus on improving the linkages between the actors in this relationship; the livestock keepers, technology developers and public and private extension services. From all this the goal was to draft a Continental Strategy which takes into account prevailing status and suggests innovative ways of improving REFILS to enhance livestock production and productivity.

To collect the relevant information and data on REFILS, stakeholders were requested through the administering of three questionnaires online in all five regions of the continent followed by three virtual workshops for the three stakeholder groups (researchers, extension agents and farmers) as well as some selected key informants. The results indicated that REFILS was almost unanimously recognized by all key stakeholders as a tool for enhancing technology development, transfer and utilization. However in practice REFILS application was sporadic and generally poor across the African continent. This was found to be largely due a myriad of constraints affecting both research and extension, respectively, and REFILS itself as a value proposition. These include poor funding particularly by the public sector, lack of policies to provide guidance in executing research, extension and REFILS programmes, lack of a REFILS culture where evidence of technologies' impact was demonstrated before adoption, and poor governance and political will in many countries. There were nevertheless some examples of REFILS programs from which best practices and lessons were drawn.

From the feedback of stakeholders and analyses of the survey results, a draft continental strategy is proposed. The strategy is underpinned by a vision and mission together with three strategic objectives, action plans and possible outcomes. The strategic objectives are to strengthen and grow REFILS capacity building and infrastructure support, to improve the REFILS policy and regulation formulation and implementation environment, and to develop, grow and strengthen advocacy and awareness creation of REFILS.

The strategy is to be implemented via three proposed models. These include working within the system with existing resources to form a coordinating board or platform that brings together all the key stakeholders; merging departments or divisions of research and extension to form a new department with a stakeholder engagement unit to make sure all players are catered for; and a third model which coordinates all technology development from development partners to make sure the correct and appropriate interventions are extended to the livestock farmers. Where possible, one could also combine all three models.

An implementation mechanism with a strong ecosystem built from the member states going up to the Regional Economic Community and the African Union Commission is proposed. The implementation is guided by transparency, collaboration, mutual respect and complementarity.

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Introduction and Background

Premised on the Science, Technology and Innovation Strategy for Africa (STISA-2024) adopted by the African Union Heads of State and Government, Livestock Development Strategy for Africa (LiDeSA) and Agenda 2063, AU-IBAR designed the “Sustainable Development of Livestock for Livelihoods in Africa - Live2Africa” project. The Live2Africa Project is a five-year innovative initiative funded by the European Union and implemented by AU-IBAR. The project runs from 2017-2021.

The overall objective of the project is “To support transformation of the African livestock sector for enhanced contribution to environmentally sustainable, climate resilient, socio-economic development and equitable growth” while the specific objective is to strengthen the systemic capacity of continental, regional and national Livestock Sector stakeholders for the economically, environmentally and socially sustainable transformation of the animal production sector.

One of the key project’s focus areas is to enhance innovation, generation and utilization of technologies, capacities and entrepreneurship skills of livestock value chain actors. Consequently, AU-IBAR would like to develop a Continental Strategy on how best technologies and innovations can be developed, packaged and transmitted to livestock keepers who are the main beneficiaries. The relationship between research as innovators, extension services as transmitters of technologies and livestock keepers as consumers of these technologies and innovations, commonly referred to as Research-Extension-Farmer linkages, has long been studied and analysed. However, despite the numerous efforts which have been expended to make the relationship between technologies and innovations and the farmers’ requirements, there appears to be a disconnection in this complex relationship.

It is important that there are strong relationships among all the stakeholders involved in the development, packaging, transmission and utilization of innovations and technologies for the livestock industry. It is also clear that these relationships have not worked well despite the efforts which have been invested in the past to enable seamless transmission of innovations and technologies to farmers.

Agricultural Research

Agricultural research can be defined as systematic, creative and detailed studies using the scientific methods in the field of agriculture. It ranges from high level basic studies at the molecular level to applied research at the farm level. In many countries National Agricultural Research Systems (NARS) exists which encompass researchers at universities, public institutions, private sector and related institutions.

The major goal of agricultural research is to improve the biotic (crops, animals, soils) and abiotic (farming tools, farming methods, socio-economics) aspects of farming. In recent years the sustainability component of this research has gained prominence. Consequently, if research findings are adopted by farmers, are they likely to lead to sustainable improvements in the production and productivity of their animals. However, these findings have to be disseminated to the farmers. This is where extension comes in. Therefore, the link between research and extension cannot be overemphasised. On paper getting the research done and then packaging it for farmers to be delivered by extension sounds straightforward. However, this is not often

the case. Key questions include the issue of location of the research. Where should the research be carried out? In recent years there have been efforts to conduct the research on or near the farm and introduce an element of co-creation/farmer participation and hence buy-in from all stakeholders. Proponents of Farming Systems Research and Sustainable Agriculture have always argued in support of on-farm research for these reasons. However, as prudent as this argument is, some research can obviously not be done on farm and will still need to be done on research stations and laboratories. This applies to much of the basic research which is important and sometimes not highly visible but underpins most of the applied research.

Another big question has been about agenda setting. Who decides what research should be done. Quite often there is a misalignment of the research being done and the challenges the farmers face. This results in a situation where farmers are forced to consume or adopt research and technologies that may not be appropriate for them. This top-down approach has often resulted in failure. For example, big crop and livestock breeding companies have often come up with genotypes that are not suitable for farmers needs and enormous amounts of money have been spent in behaviour changing efforts in order to sell these products. It is apparent that farmers should be involved in setting the research agenda based on the challenges they face. In addition, extension agents should also be involved in identifying and prioritising research goals based on their knowledge and understanding of the challenges faced by farmers. This will no doubt increase the adoption rate of the technologies developed by research in collaboration with the farmers and extension agents. Furthermore, if this condition is met then it may not matter where the research is carried out.

Research should be seen as part of the agricultural system on par with other components e.g. extension and farmers. The tendency has been to insulate and elevate research above the other components leaving it largely esoteric. This has led to the formation of a hierarchy or pyramid where research is above extension with the farmers at the bottom. This is the major reason why many agricultural development systems have remained entrenched in a top-down way of operation. For increased technology creation and subsequent uptake, farmers, extension organizations and researchers need to partner at the same level. This allows for greater interaction, collaboration and free flow of information.

The agricultural extension concept

There is no single definition that can be exclusively used to define the agricultural extension concept because the views of what it is have continuously evolved. Oakley and Garforth (1985) earlier defined agricultural extension as the means of introducing recent knowledge and ideas to farmers and farming communities for improved production and the lifestyle standards of people. Alex et al. (2002) broadly defined it as... “the rural knowledge and innovation system.” According to DAFF (2005), agricultural extension is the art of assisting various farmers with agricultural related knowledge and skills that will make them productive and competitive to ensure sustainability. Currently, the extension concept has gone beyond its traditional roles of technology transfer to facilitation, and from teaching to learning as well as assisting farmers to collectively work together and share information among themselves (Baig and Aldosari, 2013). The definition of extension should acknowledge that there is a growing body of knowledge which advocates the recognition farmers’ knowledge and experience about their farming systems and proactively incorporating it into the extension systems. Instead of using the term extension agents, some scholars

prefer using the phrase, agricultural advisory services, because the latter is a much broader context (Davis, 2008). The current study proposes the term ‘agricultural learning and advisory services’ in recognition of the broader context and the fact that the ‘learning’ is a three way phenomenon which should include farmers and ‘advisors’ in an extension system and researchers generating technologies.

There are several extension approaches used in Africa and several authors have classified them differently. Five key authors and their various classifications of extension methods have been cited in Table I. Methods vary from pure classical or conventional extension with a top-down approach to those including significant farmer participation e.g. Farmer Field Schools and Farming Systems Research. The linkage of extension to research in many of these methods is implied and not explicit. This would be the case in university based extension methods. Success of any extension method depends on its ability to assist farmers in adoption of appropriate technologies to improve their farming enterprises. It is therefore important that it involves both the knowledge generators and the adopters.

Table I: Agricultural extension approaches used in Africa as named by various authors

(Rivera, 1988)	(Axinn, 1988)	(Nagel, 1997)	(Eicher, 2007)	(Abdu-Raheem & Worth, 2016)
Conventional extension	General agriculture	Ministry-based general extension	National public extension	Ministry-based
Commodity focused	Commodity-based	Commodity-based	Commodity and research	Commodity-specialized
T&V	T&V	T&V	T&V	T&V
Technical innovation	Project approach	Integrated project approach	NGO	Project-based
University education	Educational institute approach	University-based	Farmer Field Schools (FFS)	Contracting in and out
Integrated agricultural development program	Agricultural participatory approach	Animation Rurale	Private	Demand driven/ Participatory
Farming System Research	Farming systems research			FFS
Community development	Cost-sharing			Privatization
Integrated rural development programs				Decentralization
Farmer information dissemination system				Pluralistic extension
				ICTs

Adapted from Mapiye (2020)

Technology uptake by the farmer

In Africa, farms range from small family subsistence farms to large scale outfits run at industrial scale. Researchers develop technologies which farmers receive either directly from them in some cases or in most the cases via extension agents. The major sources of technologies include public research institutions, tertiary institutes, private sector organizations and NGOs. These same entities are also involved in extending these technologies in one way or another. Farmers also play a role in technology development and uptake. This includes providing information on which technologies are needed and also which technologies are working well. Farmers also help in extending technologies among themselves while some do develop and/or adapt existing technologies. For farmers to improve their productivity in a sustainable manner, the relationship between these three entities i.e. researcher, extension worker and farmer must work

seamlessly. There are many dimensions to this relationship which need to be well understood for increased technology uptake. These dimensions not only include technical issues, but socio-economic and cultural issues as well. The relationship between farmers, researchers and extension workers has been a subject of many studies on the African continent primarily because it has not worked very well. It has been suggested that one of the tools to increase technology uptake by the farmer is the Research-Extension-Farmer Inputs Linkage System.

Research-Extension-Farmer Inputs Linkage System

Research-Extension-Farmer Inputs Linkage System (REFILS) is basically a system which brings together key stakeholders in agricultural development (research, extension, farmers, policy makers and the private sector) for the effective management of research and extension delivery for sustainable agricultural development (Arokoyo, 2019 <https://iart.gov.ng/wp-content/uploads/2019/07/An-Overview-of-30-Years-of-REFILS-in-Nigeria.pdf>). On paper this framework is quite logical and supposed to work well but in practice this is not often the case. For linkage implies the communication and working relationship established between two or more organizations in the system pursuing commonly shared objectives in order to improved efficiency of the system (Agbamu, 2000). In fact Van Crowder and Anderson (2007) concluded that flow of technology from researchers to farmers through extension is a persistent and pervasive problem.

According to Agbamu (2000) there are five types of REFILS as follows:

1. Research and extension organizations operate at the same status in a country, using a bottom up approach in decision-making on linkage activities.
2. Both organizations have the same operative status, using a top-down approach to manage the links.
3. Research and extension organizations have unequal status, and the linkage system operates according to a bottom-up management approach.
4. Both organizations are unequal in status, and the linkages operate according to a top-down management approach.
5. There is no organised linkage system between agricultural research and extension organizations.
6. Decentralisation of research and extension services is a prerequisite of these models especially where the bottom-up approach of involving farmers in identifying problems for research and decision-making in linkage.

Adoption of REFILS in Africa

The adoption of REFILS remains mostly poor across the African continent. Research and extension continue to function with very little collaboration leaving the farmer as the biggest loser. This happens despite the fact that in some countries (e.g., Zimbabwe and Gambia (Kumar et al., 2001)) they have even merged research and extension departments. Even more concerning is the observation made by Chakaire et al. (2011) who concluded that in Sub-Saharan Africa, livestock extension is often neglected in favour of crop agriculture extension.

In general REFILS has failed in Africa because of the following reasons.

- Poor funding of all components primarily from central governments. Donors have sometimes filled this space but their agendas may be different and driven by other considerations.

- Poor policy environment ranging from absence of policies to poorly designed and executed policies.
- Poor culture of looking at an integration of all components of the agricultural development system despite institutional divisions, which are likely to remain.
- Furthermore a focus on REFILS functions, instead of just its components, might broaden the dialogue to include other partners and improved integration has been missing.
- In many countries a pluralistic approach (where many players in technology development, dissemination and uptake operate independently) exists and is likely to have advantages, but to be effective there must be some coordination of the key players in the system. Linkages may be best improved through the promotion of informal networking at many levels with an incentive system that rewards collaboration.
- Failure to strengthen and empower disadvantaged groups, (e.g., women and youth farmers) who are more likely to be impacted by the technologies on offer.

Table 2 shows some selected African countries and their specific experiences with REFILS.

Table 2: State of REFILS in selected African countries

Country	State of REFILS	Reference
Ghana	State of REFILS characterised by poor funding, and poor policy environment	Doamekpor (2006)
Egypt	Disconnection among the key components. Need to build innovation into the system	Zahran et al. (2020)
Nigeria	REFILS was introduced by donors. Participation declined once donor funds dried up. Attempts to resuscitate the program underway but poorly funded.	Arokoyo (2019)
Zimbabwe	Historically good links between role players. Currently very weak farmers-extension linkages and non-existent farmer-research linkages as well as research-extension linkages.	Nyamupangedengu and Terblanché (2016)
Tanzania	Unequal status between extension and research. Decentralisation of system can help linkage between research and extension. Poor funding	Agbamu (2000)
Tunisia	Public platform exists to promote REFILS but participation limited to government only. Little or no role for NGOs and private sector. Farmer participation is low.	GFRAS (2013); Melaouhia et al. (2015)
Ethiopia	Strong and explicit structures in place to promote REFILS. Moving towards equal status between research and extension. Challenges still exist in the form of inadequate funding and poor farmer participation.	Belay and Dawit (2017)
Rwanda	Strong Linkages between REFILS role players. Research and Extension are merged. Farmer participation is high. Huge donor support base.	MacNairn (2018)
South Africa	Weak extension, strong research. Poor linkage between the two and farmers. Key policy documents not strong on REFILS. Strong emphasis on sustainable agriculture	Mapiye et al. (2019); Khwidzhili & Worth (2019); DAFF, 2014; Ngomane (2005).
Uganda	Disconnection among the key components and characterised by poor funding. Technologies being extended not matching farmer needs. Gender insensitive. Strong bias towards crop agriculture.	Nkonya et al. (2020)
Malawi	Poor funding, inappropriate and outdated technologies being extended as a direct result of lack of linkages between key components.	Ragasa and Mthinda (2020)

Farmer technology uptake and Information and Communication Technologies

Going forward the success of the concept of REFILS is going to depend on the Information and Communication Technologies (ICT) revolution. Poor access to information (FAO, 2017; Mapiye et al., 2019) has been cited as one of the main reasons for poor technology uptake by farmers. Based on many studies (Zyl et al., 2014; FAO, 2017; Trendov et al., 2019), the adoption and use of ICTs such as web-based and mobile applications present unprecedented opportunities for transforming farmers' livelihoods. Costopoulou et al. (2016) and World Bank (2017), reported a rise in demand for authentic and localised agricultural information by smallholder farmers across Africa.

Many studies have reported that ICTs play an important role in supporting agricultural extension systems because they increase the efficiency of information dissemination to smallholder farmers (Burch, 2007; Nakasone et al., 2013; FAO, 2017). Already, there are some initiatives that have been developed across the SSA region to support the delivery of extension services (Tropical Centre for Agriculture and Rural Corporation (CTA, 2019). More than half of the initiatives started in East Africa and above 60% of all registered farmers are based in that region with Kenya having the most beneficiaries. Other African regions have not yet developed to the levels in East Africa. Assertions from FAO (2017) and CTA (2019) claim that infusing public extension with ICT-based technologies can promote and hasten farmer to farmer interactions and the ability of farmers to effectively communicate with extension (feeding back) and researchers. Therefore, the continued development and implementation of innovative strategies in revolutionizing public research and extension services is therefore essential (Wesley & Faminow, 2014).

There are various agricultural mobile applications (Apps) and web-based platforms being developed and implemented to support agricultural extension delivery and hence the transformation of smallholder farmers (Costopoulou et al., 2016; World Bank, 2017). Given the need to address heterogeneous and complex farm management issues within the smallholder sector (Costopoulou et al., 2016), these initiatives are constantly evolving (growth of the "App economy") (ITU, 2014). Some of the applications being used to improve extension services delivery in SSA include Esoko, iCow, Community Knowledge Workers (CKWs), WeFarm and DigiFarm.

To conclude the review, we note that some countries have embraced the REFILS approach as a vehicle for technology development, packaging, transfer and adoption. On paper the benefits of packaging research and extension for technology development and uptake are implied and clear. The reality though is different on the ground. Only a few countries are implementing successful REFILS. The majority of the countries are struggling to establish REFILS program for a variety of reasons.

Objectives

The objectives of the consultancy are to:

1. Evaluate/interrogate/assess the development, uptake and utilization processes of technologies and innovations specific to animal resources by all key actors including public research institutions, universities, private researchers, extension services, farmers, NGOs and development partners at national and regional level and determine how these stakeholders interact in this process.

2. Review any existing models that may exist in Member States or at regional level for adoption and/or adaptation.
3. Identify for upscaling Best Practises and Lessons Learnt from the REFILS experiences (including on communication, training, product packaging and dissemination) with special focus on improving the linkages between the actors in this relationship; the livestock keepers, technology developers and public and private extension services.
4. Draft a Continental Strategy which takes into account prevailing status and suggests innovative ways of improving the relationship in REFILS to improve livestock production and productivity.

Status of REFILS in Africa

In order to gauge the status of REFILS, we engaged stakeholders in two ways. Stakeholder interaction was accomplished first by means of administering a questionnaire online in all five regions of the continent followed by a virtual workshop of selected key informants. Stakeholders consisted of farmers, extension service providers and technology developers or researchers. These included all key actors in public research institutions, universities, private researchers, private and public extension services, farmers, NGOs, and development partners.

Online Surveys

In depth interviews with stakeholders from drawn from National Agricultural Research Services (NARS), universities, non-governmental organizations, international research organizations, regional and continental bodies, and the private sector; extension agents drawn from government extension services, non-government and private extension services; and farmers to be sampled from both the upper and lower echelons of the livestock industry were conducted using a questionnaire. The surveys were conducted in all the five regions of Africa i.e. Southern Africa, East Africa, Central Africa, West Africa, and North Africa. Participants were generally drawn from AUIBAR's network and database of collaborators and those of the consultant as well. Because of COVID-19 restrictions the questionnaire was administered remotely via email. A link was provided to the responded where the respondent completed the questionnaire and submitted the responses to the consultant automatically.

Three questionnaires (see Appendix 1) were developed using Google Forms as follows: one for farmers, one for extension service providers, and one for researchers. All three questionnaires were translated into French. This survey tool consisted of a range of prepared questions used to obtain general and specific qualitative information to help identify underlying complexities in technology development, transfer and uptake. In particular the state of technology development and transfer, impediments to technology transfer, and possible solutions were be interrogated. Questions were either very specific or allowed space for the respondent to provide wider open-ended responses to mimic a conversation between an enumerator and an interviewee.

The farmer questionnaire was divided into the following sections each with a number of questions on that particular subject matter or theme; Biographical data, Farmers' access to livestock extension services, Farmers' contribution to technology development, Farmers' assessment/observation of REFILS,

and Recommendations to strengthen REFILS. The researcher questionnaire had the following sections: Biographical data, Status of agricultural research services, Contribution of research to agricultural extension services, Researchers assessment/observation of REFILS, and Recommendations to strengthen REFILS. The extension service providers' questionnaire had the following sections: Biographical data, Status of agricultural extension services, Contribution of extension service to technology development, Extension service providers' assessment/observation of REFILS, and Recommendations to strengthen REFILS.

All the data were analyzed using the Statistical Analytical System (SAS 9.4, 2012). Descriptive statistics (frequency counts, percentages, and cross tabulations) were used to analyze the respondents' socio-economic characteristics and baseline information using the PROC FREQ procedure of SAS.

Key informant virtual workshops

A second round of meetings in the form of key informant virtual workshops were conducted. Three workshops were conducted for farmers, researchers and extension service providers. The workshop panelists were carefully selected from key informants, opinion leaders and some participants of the survey (see Appendix 2). Again, the workshop had to be conducted virtually due to COVID-19 restrictions. The key informant virtual workshops concentrated on the key issues raised in the surveys. The aim was to nudge researchers, extension agents and farmers towards some common understanding on technology generation, packaging, transfer and uptake.

Guided by the consultant, each group discussed the current status of REFILS on the African continent, looked at some examples of REFILS, debated the relative importance of the constraints of technology development, transfer and uptake, and offered possible solutions to these constraints. A survey of the REFILS policy instruments on the continent and their implementation was also undertaken. Thereafter a list of lessons learnt and best practices were drawn up. Possible key elements of a continental strategy were also developed.

Findings of the stakeholder interactions on the status of REFILS

The following section captures the main findings of extension service providers, researchers and farmers from the online surveys and the stakeholder workshops. A graphical presentation of the results is also presented.

Extension service providers

A total of 50 extension service providers responded to the request to complete the questionnaire survey. Of the three stakeholders i.e. farmers, extension and research, this was the best turnout. We expect that there could have been a better response had it not been for COVID-19 induced 'survey fatigue'. Furthermore, there are a number of extension personnel who either have no access at all to ICT or do not have resources to participate in a survey of this type

Of the total respondents, 46 or 89.58% were male and the remainder female. The gender gap witnessed in the responding farmers was also manifested here with extension service providers. This is a worrying feature of the extension industry. There is need to recruit more females into the agricultural extension

industry especially since it has been established that they are likely to draw female farmers as well. In addition, they are likely to advocate for technologies that are more likely to impact directly at household food and nutrition security and livelihoods.

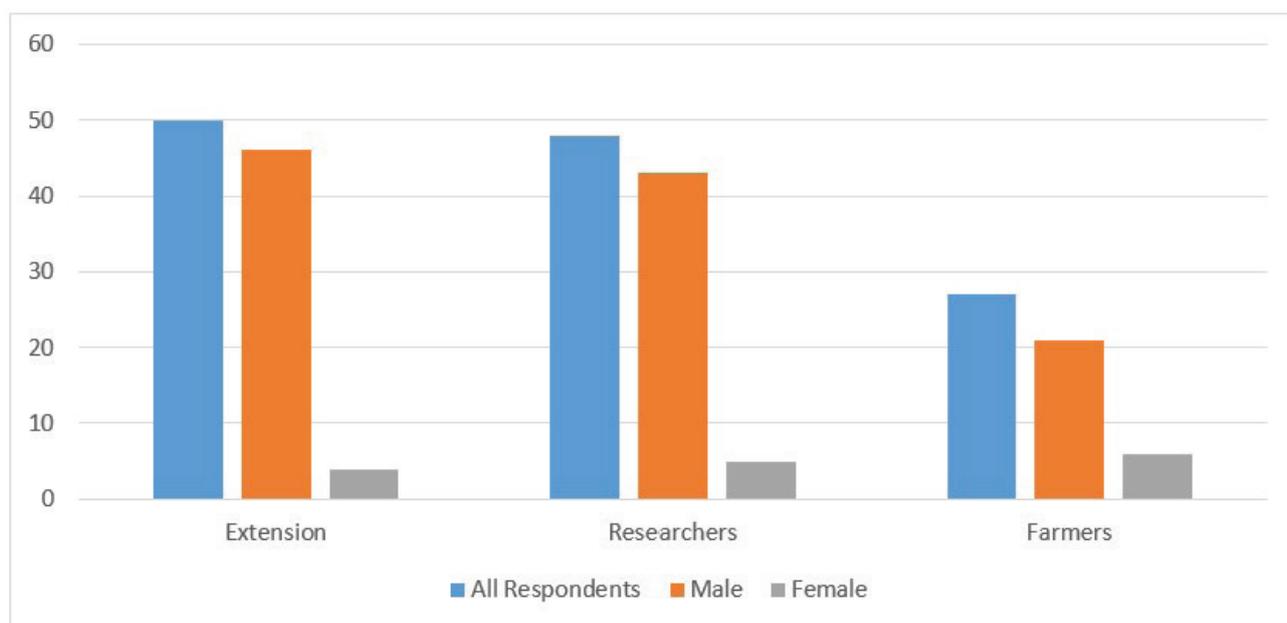


Figure 1: Survey respondents (Extension, Researchers and Farmers) by gender

All regions of the continent were represented even though the majority (82%) of the extension service providers came from Southern and Eastern Africa regions. The majority of the extension personnel were working with farmers in three major value chains namely meat and live animals (30%), dairy (32%) and poultry (18%).

The majority of the extension service providers responding indicated that they were in the public service. This is in agreement with the farmers who pointed out government as their major source of extension. The respondents were generally very experienced with 62% (31/50) having over ten years of service experience. The major extension services offered include animal health (30%), animal breeding and genetics (66%), animal nutrition (58%) and general animal husbandry (64%). Indeed the large majority (90%) of technologies extended were sourced from government researchers, while private and university researchers provided a small contribution of technologies in that order.

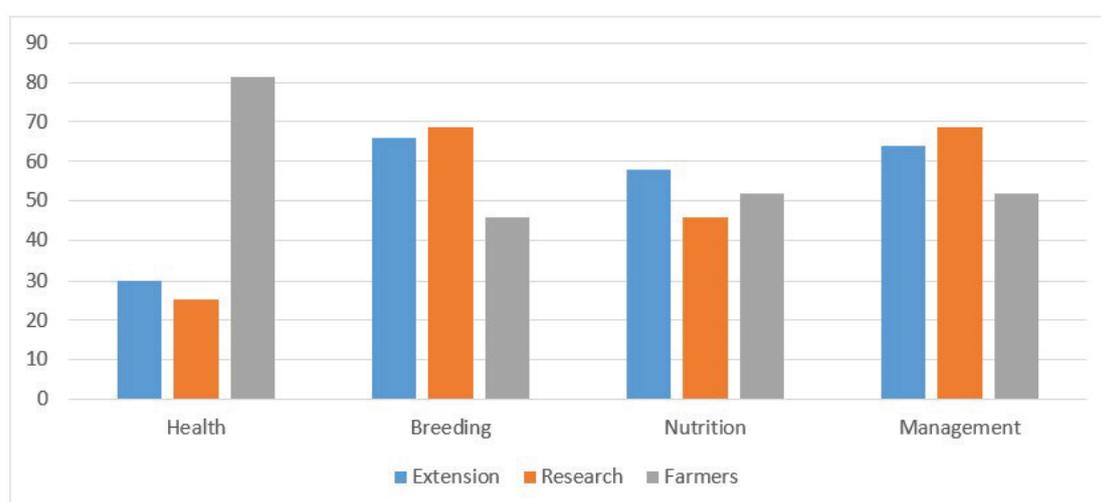


Figure 2: Services offered (%) by Extension and Research and services received (%) by Farmers by discipline

There is a general agreement between the services farmers are looking for and those being offered with one glaring exception. There is a huge disparity between the services offered in animal health in comparison to the demand. This is something that needs to be addressed by extension services so that demand and supply of services are closely aligned.

Farmers and research and extension agents generally work together in technology development and uptake through mainly traditional contact methods eg farm visits, field days, demonstrations. All the respondents mentioned that they use either the bottom up approach or a two way bottom up and top to bottom approach when working with farmers. However these methods have been largely curtailed because of the COVID-19 restrictions and lockdowns. In fact a large majority of the farmers (88.9%) and extension service providers (62%) say REFILS is not working well during the covid-19 pandemic. It is therefore interesting to note that 29.6% of the farmers are using information and communication technologies (ICT) to access extension services. Similarly 24% of the extension service providers are using ICT methods to reach out to farmers. This can bridge the gap that has been created by the pandemic but will only help the well-resourced farmers who can afford to invest in ICT.

During the stakeholders' workshop farmers also noted that ICT has potential to assist farmers and other stakeholders where the later were located in areas that are not easily accessed because of poor road networks or because of breakdown of transport infrastructure during natural disasters like floods.

A significantly large number of extension workers (86%) are involved in technology development with researchers. They do this by collecting feedback from farmers, field testing of technologies in partnership with researchers and sometimes they are involved in the actual development of the technology. However, surprisingly only 62% gave feedback to researchers on the challenges they face in technology transfer. It came out very strongly in the stakeholder workshops that the collaborations between researchers and extension specialists were mainly on an ad hoc basis and this is probably why a reduced number gave feedback. There are no established formal platforms for this type of exchange.

Regardless of these challenges, there seems to be some strong elements of REFILS present in the current interaction between farmers, researchers and extension service providers. This presents an opportunity to build a fully-fledged REFILS ecosystem based on this foundation.

In an open ended question extension services providers were asked to list some of the constraints they face in providing extension services. By putting similar issues together we were able to group the constraints into seven categories as follows;

1. Socio-economic and cultural barriers
2. Lack of infrastructure and technologies
3. Lack of financial resources
4. Lack of accessibility to farmers and researchers
5. Poor governance and lack of political will
6. Inadequate and lack of skilled human capacities
7. Lack of access to information technologies

The constraints were ranked by the extension service providers in both the survey and the workshop in the order above.

It is interesting to note that extension services ranked socio-economic and cultural barriers as the main drawback in providing extension services to farmers. In addition, lack of infrastructure and technologies, and lack of financial resources were seen as second and third most important barriers respectively. Some of the key socio-economic and cultural barriers included illiteracy, poverty, poor technology adoption rates among others. On the other hand, farmers felt very strongly about poor governance and lack of political will which they thought was the major reason for failure of African agricultural systems. They also mentioned that the quality and quantity of extension personnel was nowhere near adequate.

Extension service providers were also asked about challenges they faced in accessing and working with research services or technology development. This was also an open ended question and the responses were then grouped into the categories below. The order in which they appear is also the same order in which they were ranked by the extension service providers in both the virtual workshop and the online survey.

1. Poor linkage between research and extension
2. Lack of financial resources
3. Appropriateness of technologies developed
4. Lack of infrastructure and technologies including ICT
5. Poor governance and lack of political will
6. Socio-economic and cultural barriers
7. Inadequate and lack of skilled human capacities

Extension service providers overwhelmingly ranked the poor linkage between research and extension as the major impediment to accessing research services and technology. It was also interesting to note that they thought that some of the technologies developed were not appropriate. There is a close relationship between those two constraints. If there are no formal platforms of engagement between researchers and extension personnel then there is likely going to be incongruous demand and supply of technologies.

Views of extension service providers on REFILS

The previous sections deal exclusively with the perceptions of extension service providers and how they interact with the farmers and researchers. From the results so far a picture of a constrained system where the value of collaboration among the key players i.e. farmers, research and extension is recognised but not formally instituted begins to emerge. When asked the question 'Is REFILS a good system for developing and utilizing appropriate livestock technology' 89.4% of the extension service providers agreed or strongly agreed with the statement. When asked if REFILS improves dissemination and utilization of technologies, 95.8% said it did. Furthermore, 89.4% of the extension service providers agreed that the system allows direct and collaborative interaction among all stakeholders (researchers, extension services, farmers).

There are no formal REFILS structures formally embedded in both public and non-public services. In a guided question the extension service providers were asked to rank some of the reasons why there is a

poor linkage between the three entities. The top five reasons for poor linkages between farmers, research and extension were given as follows;

1. Lack of functional microfinancing support systems
2. Poor advocacy strategies of technology adoption benefits
3. Lack of effective impact assessments of new innovations and technologies
4. Lack of evidence based needs assessments (farmer-led)
5. Weak public and private sector partnerships

Lack of funding was given as the top reason or cause for poor linkage between farmers, research and extension. The three causes which were also scored highly by extension service providers imply that technologies need to be demonstrated and the evidence that they work be shared with the farmers.

This information is vital for any future development of REFILS programs and their institutionalisation thereafter as it will guide the formulation of best practices.

Researchers

A total of 48 researchers working in livestock technology development responded to the request to complete the questionnaire survey. We expect that there could have been a better response had it not been for COVID-19 induced 'survey fatigue'. Furthermore, there are a number of research personnel who either have no access at all to ICT or do not have resources to participate in a survey of this type.

Of the total respondents, 43 (89.6%) were males, with only 5 females responding. The gender gap witnessed in the responding farmers and extension staff was also manifested here with researchers. There is need to close this gender gap for the same reasons made for the case to recruit more female agricultural extension service providers i.e. more female researchers are likely to draw females farmers as well and that they are likely to advocate for technologies that are more likely to impact directly at household food and nutrition security and livelihoods.

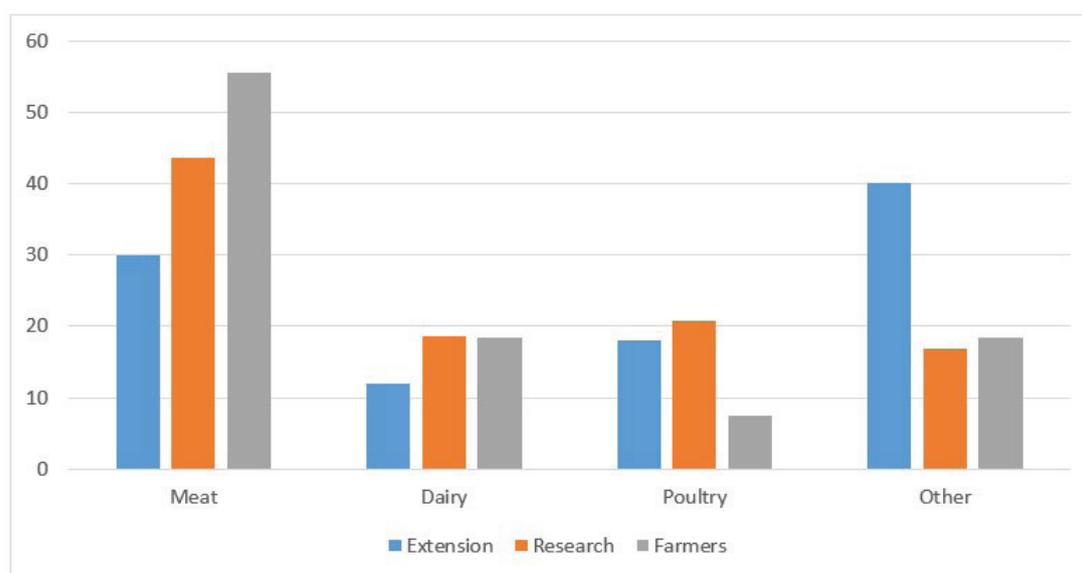


Figure 3: Value Chains (%) in which responding Extension agents, Researchers and Farmers are working in.

All regions of the continent were represented even though the majority (62.5%) of the researchers came from Southern and Eastern Africa regions. The majority of the research personnel were working with farmers in three major value chains namely meat and live animals (43.7%), dairy (18.7%) and poultry (20.8%).

The majority of the researchers (34) responding indicated that they were in the public service followed by those (13) who were with universities. The respondents were generally very experienced with 70.8% (34/48) having over ten years of service experience. The major research services offered include animal health (25%), animal breeding and genetics (68.7%), animal nutrition (45.8%), animal reproduction (37.5%) and general animal husbandry (68.7%). The major technologies developed were mostly in feeding and nutrition, breeding and reproduction in that order. Only one technology was mentioned in animal health. This is not in line with farmer demands as most of them ranked animal health as their top need. This is something that needs to be addressed so that demand and supply of services are closely aligned.

Farmers and research and extension agents generally work together in technology development and uptake through mainly traditional contact methods eg farm visits, field days, demonstrations. All the respondents mentioned that they use either the bottom up approach or a two way bottom up and top to bottom approach when working with farmers and farmer groups. However, these methods have been largely curtailed because of the COVID-19 restrictions and lockdowns. In fact a large majority of researchers (70.8%) compared to 88.9% of the farmers and 62% of the extension service providers say REFILS is not working well during the covid-19 pandemic. The potential to use ICT methods to improve interaction between farmers, research and extension during pandemics like COVID-19 or during natural disasters should be explored. Farmers and extension service providers are already using ICT methods in their interaction as reported earlier.

A significantly large number of researchers (87.5%) indicated that they are involved in technology development with extension service providers. This is almost the same number (86%) of respondents when extension service providers are asked the same question which further validates the strength of this relationship. When it comes to farmers, 91.7% of researchers are working with farmers in technology development. From the farmers' side the figure is 81.5% which again implies strong collaborative linkages.

Even though the surveys and the stakeholder workshop indicate some linkages between extension and research, there is no recognised platform facilitating this and these collaborations between researchers and extension specialists were mainly on an ad hoc basis.

Regardless of these challenges, there seems to be some strong elements of REFILS present in the current interaction between farmers, researchers and extension service providers. This presents an opportunity to build a fully-fledged REFILS ecosystem based on this foundation.

In an open-ended question researchers were asked to list some of the constraints they faced in providing technology research and development services. By putting similar issues together it was possible to group the constraints into seven categories as follows;

1. Lack of financial resources
2. Socio-economic and cultural barriers
3. Inadequate and lack of skilled human capacities
4. Lack of infrastructure and technologies
5. Lack of accessibility to farmers and extension service providers
6. Poor governance and lack of political will
7. Lack of access to information technologies

The constraints were ranked by the researchers in both the survey and the stakeholders' workshop in the order above.

It is interesting to note that three of the top four highest ranked constraints of the extension service providers are similar to those of researchers. According to these two stakeholders, socio-economic and cultural barriers and poor funding are important drawbacks in providing both research and extension services to farmers. Poor governance and lack of political will which were highly rated by the farmers seem to play minor roles in what the researchers and extension service providers see as major constraints to service delivery. If the three stakeholders do not share the same concerns, it may be difficult to develop REFILS programs for livestock technology development, transfer and uptake.

Researchers and technology developers were also asked about challenges they faced in accessing and working with extension services. This was also an open ended guided question and the responses were then grouped into the categories below. The order in which they appear is also the same order in which they were ranked by the extension service providers in both the virtual workshop and the online survey.

1. Inadequate and lack of skilled human capacities
2. Lack of infrastructure and technologies including ICT
3. Poor linkage between research and extension
4. Lack of financial resources
5. Socio-economic and cultural barriers
6. Appropriateness of technologies developed
7. Poor governance and lack of political will

Even though extension service providers overwhelmingly ranked the poor linkage between research and extension as the major impediment to accessing research services and technology it was viewed as the third most important challenge faced by researchers in accessing extension services. Poor and appropriate capacity was ranked first followed lack of infrastructure and technologies including ICT. These did not rank highly when the same question was posed to extension workers. Appropriateness of technologies developed did not rank high for researchers as it did for extension service providers. This implied that these two important stakeholders have two very different views on the technology being developed.

In general, researchers seem to view their constraints in accessing extension services differently than how extension service providers view the constraints they encountered in working with researchers. Again, it is important to further elucidate the way in which these two groups view each other so as to build strong

REFILS platforms going forward.

Views of researchers on REFILS

The previous sections deal exclusively with the views and perceptions of researchers and how they interact with the farmers and extension service providers. From the results so far a picture of a constrained system where the value of collaboration among the key players i.e. farmers, research and extension is recognised but not formally instituted begins to emerge. When asked the question ‘Is REFILS is a good system for developing and utilizing appropriate livestock technology?’ 95.8% of the researchers agreed or strongly agreed with the statement. When asked if REFILS improves dissemination and utilization of technologies, 95.8% said it did. Furthermore, 62.5% of the researchers agreed that the system allows direct and collaborative interaction with extension services.

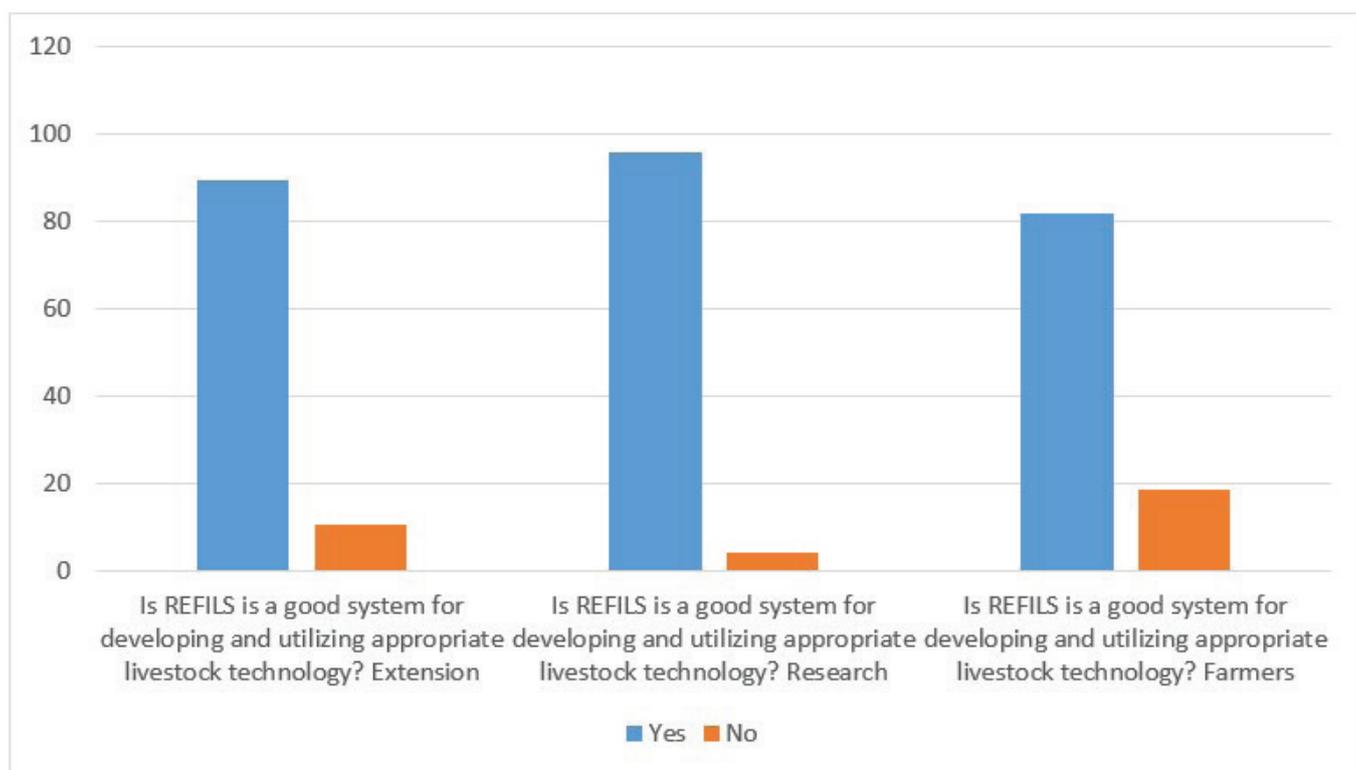


Figure 4: Extension agents, Researchers and Farmers views on REFILS

There are no formal REFILS structures formally embedded in both public and non-public services. In a guided question the extension service providers were asked to rank some of the reasons why there is a poor linkage between the three entities. The top five reasons for poor linkages between farmers, research and extension were given as follows;

1. Lack of functional microfinancing support systems
2. Lack of effective impact assessments of new innovations and technologies
3. Poor advocacy strategies of technology adoption benefits
4. Lack of evidence based needs assessments (farmer-led)
5. Weak public and private sector partnerships

Almost exactly the same picture emerges in the responses of the researchers when compared to those of the extension services in responding to the question on the poor linkages between farmers, research and extension. Lack of funding was given as the top reason or cause for poor linkage between farmers,

research and extension. The three causes which were also scored highly by extension service providers imply that technologies need to be demonstrated and the evidence of their efficacy be shared with the farmers.

This information is vital for any future development of REFILS programs and their institutionalisation thereafter as it will guide the formulation of best practices.

Farmers

A total of 27 farmers responded to the request to complete the questionnaire survey. While this may seem like a small number on paper, one has to look at the backdrop in which this survey is being done. Two factors contributed to the response not being exactly what we expected i.e. many farmers across the continent especially those who are resource poor cannot afford the hardware, software and data required for one to be online and secondly the COVID-19 pandemic resulted in virtually all surveys being conducted in this manner i.e. online which resulted in 'survey fatigue' in many potential respondents.

Of the total respondents, 21 were male and the remainder female. The gender gap in farming has always been an issue in African agriculture. There is need to recruit more females into the agricultural industry at all levels. Women are more likely to plough back the proceeds of farming into household nutrition, food security and livelihoods. For those responding 55.6% are over fifty years of age and only 14.8% are below thirty-five years of age. This is worrying as we have an ageing group of farmers in the majority and a smaller percentage of young farmers. This implies that there is no pipeline succession where young farmers will replace the old farmers when they retire. Of the responding group, just over half (51.8%) were full time farmers and the rest were part time farmers. All regions of the continent were represented even though the majority (81.5%) of the farmers came from Southern and Eastern Africa regions. The majority of the farmers were involved in three value chains namely meat and live animals (55.6%), dairy (18.5%) and poultry (7.4%) in that order.

According to the farmers, government (62.9%) private farming companies (44.4%) and farmer organizations (29.6%) are the dominant extension service providers. They receive the following extension services; animal health (81.5%), animal breeding and genetics (59.6%), animal nutrition (51.8%) and animal husbandry (51.8%) in that order. It is concerning that this is not congruous with the services offered by both research and extension services. Even though animal health was in high demand, it was not as highly ranked in terms of extension services offered by both research and extension organizations.

The majority of farmers (88.9%) mentioned that they give feedback to extension workers on the technologies they are adopting. Furthermore, twenty-three farmers (85.2%) are involved in technology development with researchers. This confirms the strong assertion by both research and extension service providers that they use either the bottom-up approach or a two way bottom up and top to bottom approach when working with farmers. There seems to be some strong elements of REFILS present in the current interaction between farmers, researchers and extension service providers. This presents an opportunity to build a fully-fledged REFILS ecosystem based on this foundation.

Farmers and research and extension agents generally work together in technology development and uptake through mainly traditional contact methods eg farm visits, field days, demonstrations. However these methods have been largely curtailed because of the COVID-19 restrictions and lockdowns. In fact a large majority of the farmers (88.9%) say REFILS is not working well during the covid-19 pandemic. It is therefore interesting to note that 29.6% of the farmers are using information and communication technologies (ICT) to access extension services. Similarly 24% of the extension service providers are using ICT methods to reach out to farmers. This can bridge the gap that has been created by the pandemic but will only help the well-resourced farmers who can afford to invest in ICT.

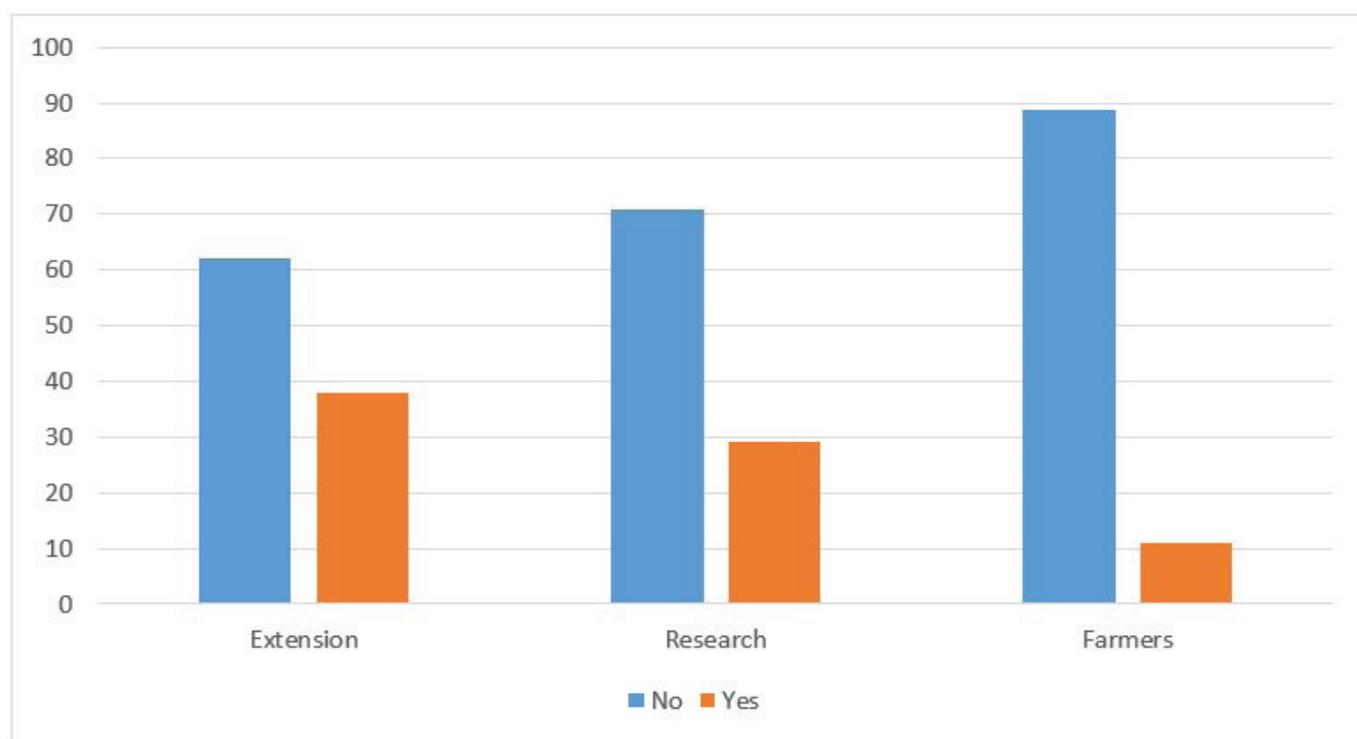


Figure 5: Is REFILS working well during the COVID 19 pandemic?

During the stakeholders' workshop farmers also noted that ICT has potential to assist farmers and other stakeholders where the later were located in areas that are not easily accessed because of poor road networks or because of breakdown of transport infrastructure during natural disasters like floods.

In an open-ended question, farmers were asked to list some of the constraints they faced in accessing extension services. By putting similar issues together, we were able to group the constraints into seven categories as follows;

1. Poor governance and lack of political will
2. Inadequate and lack of skilled human capacities
3. Lack of infrastructure and technologies
4. Lack of accessibility by and extension workers
5. Lack of access to information technologies
6. Lack of financial resources
7. Socio-economic and cultural barriers

The constraints were ranked by the farmers in both the survey and the workshop in the order above. The farmers felt very strongly about poor governance and lack of political will which they thought was the major reason for failure of African agricultural systems. They also mentioned that the quality and quantity of extension personnel was nowhere near adequate. Surprisingly lack of financial resources was not ranked highly ending up second from bottom on the priority list. It was argued that if the resources currently available are managed optimally they could go a long way in assisting extension programs and ultimately REFILS.

Farmers were also asked about challenges they faced in accessing and working with research services or technology development. This was also an open-ended question and the responses were then grouped into the categories below. The order in which they appear is also the ranking that was assigned by the farmers in both the virtual workshop and the online survey.

1. Inadequate and lack of skilled human capacities
2. Poor governance and lack of political will
3. Poor linkage between research and extension
4. Lack of infrastructure and technologies including ICT
5. Lack of financial resources
6. Socio-economic and cultural barriers
7. Appropriateness of technologies developed

In addition to the first two constraints which swapped ranks, the poor linkage between research and extension was cited as one of the major impediments to accessing research services and technology. Once more shortage of money did not appear to be a huge constraint.

Farmers' views on REFILS

When asked the question 'Is REFILS a good system for developing and utilizing appropriate livestock technology?' 81.5% of the farmers agreed or strongly agreed with the statement. When asked if REFILS improves dissemination and utilization of technologies, 77.8% said it did. Furthermore, 51.85% of the farmers agreed that the system allows direct and collaborative interaction REFILS with extension services.

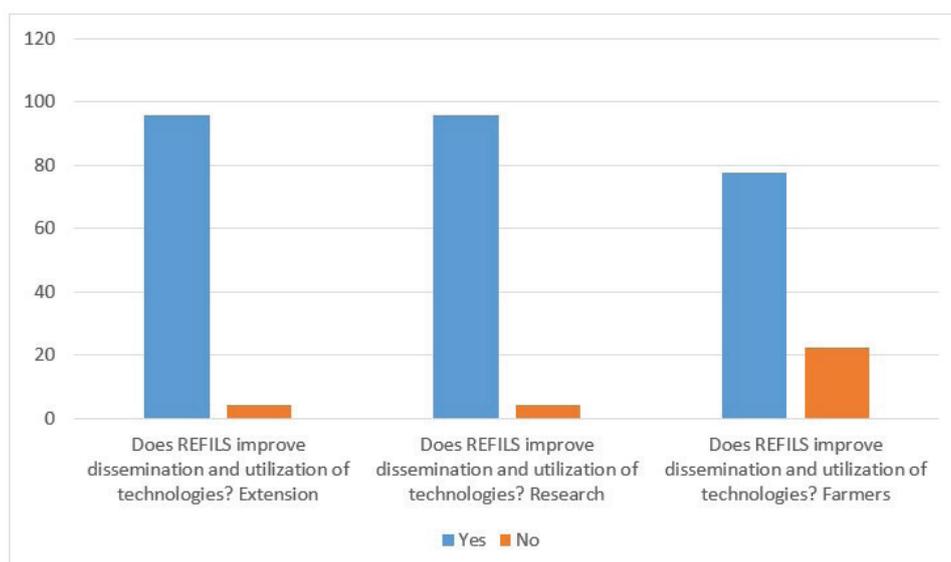


Figure 6: Extension agents, Researchers and Farmers views on REFILS

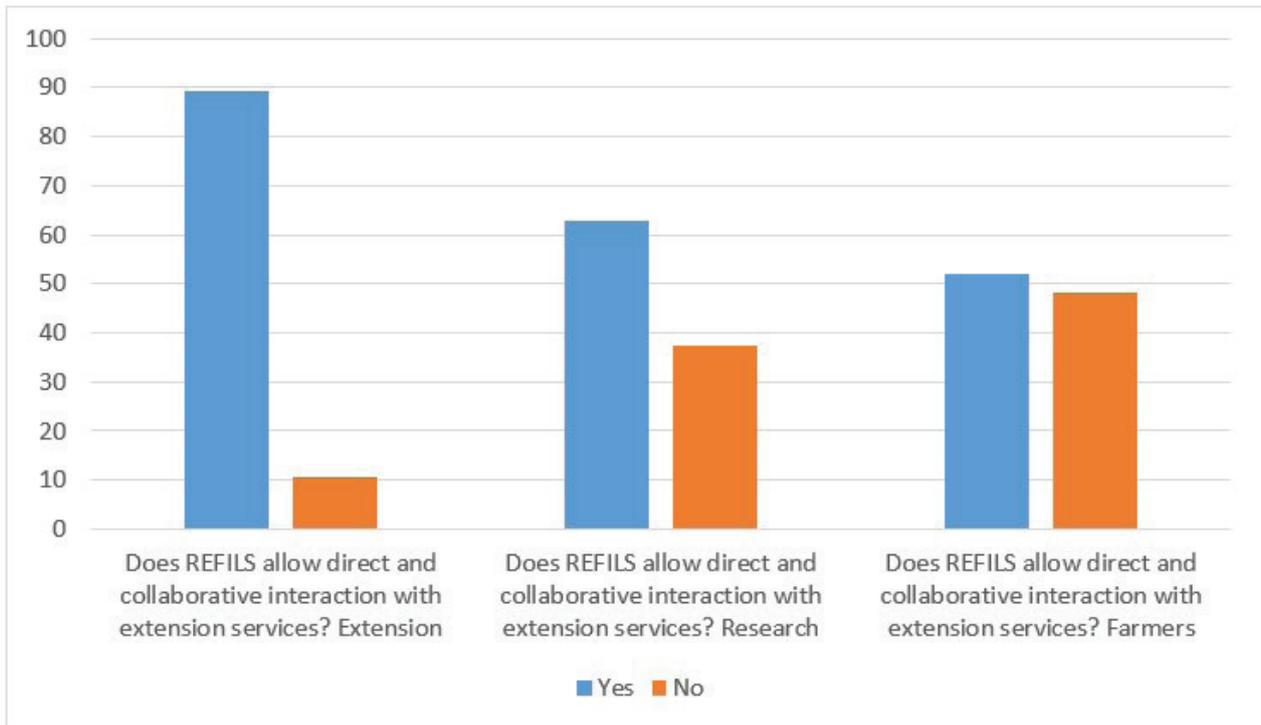


Figure 7: Extension agents, Researchers and Farmers views on REFILS

During the stakeholders workshop the farmers felt strongly that on paper REFILS is a good vehicle technology transfer but it was the lack of an enabling environment which led to poor implementation. They attributed this largely to lack of political will and poor governance. This was a stark difference from researchers and extension agents' viewpoint who did not rate governance as highly. This can be attributed to the fact that farmers are on the ground and recipients of poor service delivery are likely to have given this issue more thought.

Review of some existing models of REFILS

Even though the application of REFILS across the African continent is sparse and sporadic, there are some examples of its application both in the past and present. During the course of the stakeholders' workshop a number of examples of situations where REFILS has been applied or used were presented and discussed. From these examples we were able to formulate some REFILS best practices and lessons learnt. Three examples are described below. Each example is unique. The first model is an example of a home-grown cattle breeding program which tries to link farmers to research and extension funded by public and private finance. The second model is an example which is driven by a donor and illustrates the problems that can arise if proper linkages are not properly established and if farmers are not properly consulted. The last example is a broad attempt to institutionalise REFILS in public technology development, transfer and uptake.

The South African Nguni cattle program

The Nguni cattle program was initiated in the Eastern Cape Province of South African in 2004 and has now expanded to virtually all other provinces thus making it a truly national program. The objective of the program was to establish and conserve Nguni nucleus herds and/or upgrade the cattle herds to Nguni type for both subsistence and commercially oriented cattle producers. In each province, a tripartite partnership was established among Industrial Development Cooperation (a parastatal funding organization), Provincial

Department of Agriculture and a local university. The IDC was the main contributor, which provided financial assistance to acquire Nguni cattle and additional grants for support services. The Provincial Department of Agriculture provided extension and technical support staff and facilitated relevant infrastructural development in beneficiary communities. The local university provided research and training services on cattle farming including reproduction, animal health, rangeland production, marketing and financial management. In addition the chosen beneficiary farmers were organized into development committees.

Selection of beneficiaries was based on key pre-existing conditions including cattle farming and entrepreneurship skills, ownership or proven physical access to sufficient fenced grazing areas, rangeland management plan with specified stocking rates and existence of a development committee. The development committee was in charge of rangeland management, lobbying for government support services and overseeing the redistribution of animals to subsequent beneficiaries upon repayment of loans. In addition, a local program manager was employed as a link person between beneficiary communities and the program partners. Individuals or communities that met the selection criteria received an interest-free loan of pregnant Nguni heifers and a bull for a period of 5 years. Loan repayment after 5 years was through a similar herd or cash equivalent of the herd at the set repayment date. The herd or its cash equivalent would be passed on to other beneficiaries for horizontal expansion of the program. The program in total is estimated to be valued around half a billion Rands (equivalent to 36 million USD) at the moment. The loan repayment was reported to be slow with less than 20% of the beneficiaries having completely repaid after the first 10 years and the majority still at various stages of repayment. This, coupled with the decline in continued support has led to stagnation of the program.

The program has however managed to stimulate a working relationship between farmers, university researchers and public extension workers that was hitherto not present. Even though the project initially did not include government researchers, the project managed to get some of them involved as well.

The goal of the project was to boost the livestock industry in communal areas by creating new cattle commercial farmers. This would in turn lead to development of associated industries like abattoirs, tanneries and downstream value added entities and ultimately improve not just food security, but also employment and livelihoods of communities. Although this goal is yet to be achieved, there is no doubt that the cattle production has been stimulated with time this could lead to other downstream goals being met.

Australian Centre for International Agricultural Research projects in Zimbabwe and South Africa

The Australian Centre for International Agricultural Research (ACIAR) jointly initiated a binational project for northern South Africa and Zimbabwe in the mid-1990s. The project partners included the Commonwealth Scientific and Industrial Research Organization (CSIRO), Government Research and Extension departments in Zimbabwe, Limpopo Department of Agriculture (LDA) and the University of Limpopo. The project explored the suitability of a range of ley-legume species for improving forage availability for ruminant livestock in low-input farming areas. Tropical legumes, including *Chamaecrista rotundifolia* (Wynn cassia) and *Stylosanthes scabra* (shrubby stylo), were identified to have considerable potential for improving forage availability in both South Africa and Zimbabwe. However, the communal land

tenure system and limited financial resources of low-input cattle producers were the major barriers to the successful adoption of the legume technologies in the sector. Perhaps the biggest reason for the failure of the project was that the technology was introduced in a top-down approach with little input from farmers. In the second phase of the project, which was only implemented in South Africa, the goal of the project was to improve indigenous cattle genotypes to enable low-input producers to achieve continuous improvement of profitable production and marketing of beef. The selection criteria for recipient low-input cattle producers involved producers from a previously economically disadvantaged background who used indigenous breeds and/or their crosses and whose enterprises had the potential to become viable businesses. Selected cattle producers made a commitment to phenotype their cattle through membership of the Beef Performance Testing Scheme in South Africa. In addition, producers were expected to commit to meet the formal beef market specifications, thereby improving profit and livelihoods. Recipient producers and locally based extension and research support staff had to be willing to work in self-selected local groups or networks which would hold continuous improvement meetings every 60–90 days for 5 years. Finally, the cattle producers were required to be willing partners in a marketing group, alliance or beef improvement network. The project is still on-going and has made some strides. The farmers in the project were much more involved in the project and therefore took some ownership of the project. One of the biggest lessons learnt from this project is that it is important to include and empower farmers from the beginning of the project.

Farming Systems Research-Extension approach in Sub-Saharan Africa

The Farming Systems Research-Extension (FSR-E) approach is centred on solving farmer problems through holistic, systems-based, localised and iterative technology development and delivery processes and therefore meets many of the REFILS characteristics very well. The objective of FSR-E approach is to develop practices that are tailored to fully meet the heterogeneous demands of the farmers. FSR-E is commonly practiced in many parts of Southern and Eastern Africa since the eighties.

The primary assumption of the FSR-E approach is that technology which fits the needs of the farmers, particularly the smallholders is not available and can be created locally and therefore, the agricultural extension content must be developed off-research station but through on-farm research processes involving local farmers and their farms. Success of the approach is measured based on the extent to which farmers adopt the technologies created by the programme and continue using them with time.

The main advantage of FSR-E approach is that, first, it provides a model for understanding challenges and constraints faced by the farmers and how they deal with them. Thus, research and extension programmes are developed through an understanding of farmers' needs and not from prescriptions by research scientists and extension agents. This approach is likely to address the farmers' cogent concerns over off-farm activities, like food and nutrition security, sustainability, risk reduction, income and employment opportunities.

On the negative side, this approach is costly to implement, and results are obtained slowly as it takes more time to study and understand the farm system and its elements in their natural ecosystems. It requires a change of mind set of all the actors in the system.

The FSR-E was well established in Zimbabwe, where it was championed through the Farming Systems Research Unit under the Department of Research and Specialist Services. The Department of Agricultural Technical and Extension Services (AGRITEX) through its extension workers were the ones more visible and active at the grassroots level identifying farmers and monitoring on-farm trials. The approach has also been well established in countries such as Senegal and Zambia. The Southern and Eastern African Association of Farming Systems Research-Extension (SEAAFSR-E) is the biggest regional networking association, which accelerates agricultural and rural development in Southern and Eastern Africa by promoting FSR-E. It links its members through conferences, seminars, and capacity building workshops. Some of the member states of this association where FSR-E is practiced include, Namibia, Ethiopia, Tanzania, South Africa, Kenya and Uganda.

The World Bank funded Nigerian REFILS model

After several years of the poor technology transfer, the Nigerian agricultural production industry began to realise the futility of the linear and hierarchical approach that put research on top of extension and the farmers at the bottom. After securing significant World Bank funding, the Farming Systems Research-Extension was adopted because its holistic farmer centred approach to technology transfer. This was the first real effort in participatory technology development as it focused on identifying farmers' problems and constraints to production and designing both researcher- managed, and farmer-managed on-farm trials to solve the identified problems. Under the approach, diagnostic surveys, were conducted before implementing the on-farm trials. Five zonal Commodity Research Institutes were identified and given the mandate to implement FSR-E needs of each of the regions as follows: IAR/ABU Zaria, for the North West, LCRI Maiduguri, for the North East, NCRI Baddegi, for the Middle Belt, IAR&T/OAU Ibadan, for the South West, and NRCRI Umudike, for the South East Zone. Reviews done after several years of implementation of FSR-E from 1974-1990 concluded that the linkages among farmers, extension and researchers had somewhat improved but remained weak.

The critical need to develop very strong linkages between the Research, Extension, Farmers and the private sector for sustainable agricultural development, led to the conceptualization and establishment of REFILS in 1990. This model built on the successes of the earlier FSR-E program. The strategy not only strengthened the traditionally weak linkages between research and extension, it also has identified and brought in other key actors in agricultural research like the universities and new extension service delivery providers such as the NGOs and policy makers as well. Several activities involving all key stakeholders for example surveys, planning, implementing and managing farmer-led and researcher-led technology development trials were carried out regularly from the lowest level all the way to the national level. This led to an improvement in technology transfer in the agricultural sector particularly in the crop sector. However there was a significant decline in REFILS activities when the World Bank assistance was terminated in all zones except two. In addition, national government funding also declined in all of agriculture in real terms.

There is potential to resuscitate REFILS in Nigeria if the policy environment is cleared up allowing it to be institutionalised. This will allow farmers and other stakeholders to be better organised and educated about REFILS. In the previous efforts the private sector played a very small role in the REFILS programs. This will have to change going forward. Federal government will need to increase its funding. An opportunity was

lost when funding was available to create an exit strategy where the World Bank project would be weaned onto national government funding.

Best Practices and Lessons learnt

Best practices

From the preceding examples and in discussions with the stakeholders, it is clear that there are not many best practices to fall back on given the low adoption of REFILS on the continent. One of the most important questions is ‘How do we best align the three key components of REFILS i.e., farmers, extension and research?’ The answer lies in creating a platform that resembles a flat structure both in shape and function. That way dialogue is strengthened and communication is not top to bottom as is the case in most countries currently. This platform or body will bring together research, extension and farmers as the key stakeholders. Farmers’ participation must be more than mere tokenism. In turn the farmers must strengthen their farmer organizations so that they are properly represented and are able to communicate their needs with one voice. Where opportunity exists, other players like private sector and development partners can be invited to contribute to this platform.

Another important question to be asked is ‘What is the best implementing mechanism of a REFILS program?’ The way REFILS is implemented varies from country to country and best practices are often designed to suit local conditions. Some countries have gone for a full merger of the research and extension departments while some may create mechanisms that facilitate the working together of the two departments and the farmers. Merging and streamlining of departments may end up saving the meagre resources if implemented properly.

Technologies should be adopted only when the evidence of their efficacy has been fully documented and their impact demonstrated. This process can be made easier if farmers are co-creators of the technology and are involved at the beginning of technology development. The farmers could identify the problems/challenges and where possible, suggest potential solutions. That will ensure their ownership of the process as well as the technology to be developed with the researchers. Where donor partners are involved, they need to be fully briefed and familiarized with the local technology development issues.

From the stakeholder workshops it became very clear that FSR-E had evolved to be an integral part of many departments and ministries of agriculture. This was contrary to the belief that the system had ceased to be practiced. The real problem was identified as the drying up of funding for FSR-E particularly from the main public sector. It is therefore important to imbed technology development, transfer and uptake in FSR-E structures that still exist in some countries, particularly in Southern and Eastern Africa.

Because a policy provides a road map and guidance, it is important that all countries have legislated policies on REFILS which clearly stipulates the roles of all stakeholders involved. Based on these policies, action plans and strategies can then be developed in which goals and objectives, deliverables and timeframes are clearly spelt out. Furthermore, policies need to reside with the relevant ministries and departments. For example, an agricultural research policy residing in the ministry of science and technology is not properly

situated and is not likely to be implemented.

Some lessons learnt

There seems to be no disagreement from the majority of the stakeholders on the need for researchers and extension service providers to work together if livestock farmers are to get the most appropriate of technologies. The only problem is that the formal platforms on which to build these critical collaborations are absent in the majority of the African countries. Policies need to be developed that govern the creation and functioning of these platforms. Many REFILS practitioners have nowhere to find guidance on how to work with other stakeholders. In fact in some systems it is discouraged to work across domains.

Many countries, however, have learnt that the existence of policies does not necessarily translate into their implementation. In a number of countries where research and extension policies exist, the collaboration between these two and the farmers is either implied or explicitly stated but not enforced. The success story from Rwanda illustrates that policies and strategies need to align and create platforms and institutions which put all stakeholders around the same table.

In many of the discussions on REFILS, funding seems to be one issue that keeps on cropping up. Many workshop delegates felt that the funding for research, and extension as standalone entities was already poor which meant funding for REFILS was not going to be any better. Funding from the main public fiscus remain abysmal and other funding agencies have moved in to try and fill that gap. The examples from Southern Africa highlight three types of funding i.e. indirect government funding e.g. the Nguni project, direct government funding as in the FSR-E, and international donor funding e.g. the ACIAR project. The biggest lesson from this seems to be the fact that government funding is the best way to go as donor funding tends to be short term and might come in with different sets of goals and ideas which could be at tangent with government and detrimental. The Maputo (2003) and Malabo (2014) Declarations of the African Union made commitments for member states to commit at least 10% of their national budgetary resources to agriculture. Very few countries have met that target and many have not.

The private sector can potentially become an important partner in REFILS. From both the survey and the stakeholder workshop discussions, it is clear that the private sector contributes to both technology development and transfer. Companies with research and development units tend to combine both extension and research in a packaged format. In many African countries though, the private sector is poorly developed and therefore have little to contribute.

For farmers to readily accept and adopt technologies that are on offer, they need to have buy-in into the process from the very beginning. This means communication channels have to be both ways i.e. from and to the farmers. This calls for a flat structure as opposed to a hierarchical one. In many of the cases in Africa, the hierarchy puts research on top followed by the extension service providers and then farmers at the bottom. In this structure communication with the farmers often becomes token and not part of the co-creation required for REFILS to work optimally. However, it also became apparent that communicating, teaching or demonstrating livestock technologies is more complicated than working with crops where destructive sampling can be practised more easily.

The wide gender gap (see capacity building) in the livestock sector may not be easy to close as females tend to shy away from livestock related studies at tertiary institutions.

Good governance is not just about having a stable functional government in place with periodic elections taking place. It is also about how a stable government creates and implements appropriate policies and strategies which will create conducive environment for REFILS to function. Off course it goes without saying that peace and stability are pre-requisites for a functional REFILS program.

One of the most lessons learnt is that any REFILS program must be well situated in the appropriate government ministry or department. Ministries of Agriculture sometimes include or exclude livestock depending on the country. Some countries have specific whole ministries livestock. Furthermore, it should be clear who is responsible for and executes REFILS policies otherwise they get lost in the bureaucracy. Related to the governance matter is the issue of political will. Many governments lack the political will to implement policies on which they spend so much time, resources and effort creating. The same applies to the regional and continental level policies and instruments e.g. Malabo and Maputo Declarations.

Policy environment

Many African countries do not have properly legislated policies governing agricultural research and extension. In fact, in West Africa only one country i.e. Liberia has an extension policy. The majority of countries have a variety of projects and plans which however, do not pass as policy instruments. This was confirmed by the participants of the stakeholder workshop. These projects and plans were sometimes driven by donors and were only active during their course or lifetime.

There are some examples of proper policies in some countries. In Ethiopia, the National Agricultural Extension Intervention Program (NAEIP) formulated in 1995 has been further refined under the Growth and Transformation Plan (GTP) which was first unveiled in 2010 and still currently the guiding policy for extension and research. This policy has seen some of the most significant growth and expansion of extension services in the country largely in quantitative but not qualitative aspects. The GTP also defines research policy but despite this, the link between extension and research activities remains weak.

In Malawi, the National Agricultural Extension Policy was formulated 2000 and is being further developed under the National Agricultural Policy which also covers agricultural research aspects.

In Uganda, the overarching National Agricultural policy was approved in 2013. Soon after, the National Agricultural Extension Policy was formulated in 2016. This was followed by a five-year National Agricultural Extension Strategy 2016-2021. A parallel agricultural research Act is also in place in the form of the National Agricultural Research Act. However, there is little information on how research and extension should link up to help achieve the goals which the plans aim to achieve.

In Rwanda, they have similar policy tools and documents to those in Uganda i.e. National Agriculture Policy approved in 2018, a national extension policy and also a strategy. In order to remove the barriers between research and extension the country created the Rwanda Agriculture and Animal Resources Development

Board. Under this entity the technology development and transfer units (research and extension) for various commodities are combined. This is perhaps the best example of research and extension working together in Africa.

In South Africa agricultural research and extension are run from two different government departments i.e. department of higher education, science and innovation for agricultural research and department of agriculture for extension, respectively. The same arrangement is found in Botswana. The interaction between research and extension is often mentioned in all the key policy documents but in practice this is not particularly evident.

In Tanzania, the policy space is well defined because of the existence of a ministry responsible for the one commodity i.e. livestock. While this forms a sound foundation, there are still no clear and defined linkages between research and extension.

During the stakeholders' workshops and surveys, it was concluded that no country has an explicit policy document governing REFILS on the African continent. This is surprising given that many of the national documents and literature on the subject matter we reviewed promote it as an important tool for technology development and transfer.

Except in some few cases e.g. Rwanda and Tanzania, the stakeholder workshop participants indicated that farmers were not always included in policy development process. Furthermore, they were almost unanimous in pointing out that where policies existed, the implementation was poor.

In those countries where policies existed, there was sometimes confusion on the ownership and execution of policies. For example, agricultural policies might reside with the ministry of agriculture or livestock but the research policy might reside in the ministry of science and technology. That meant only the extension policy was fully under the agriculture ministry. This was the case in Botswana and also to some extent in South Africa. Obviously, this led to further disjunction between agricultural research and extension.

Capacity building

The agricultural industry is dominated by men. In this assignment all facets including the surveys and stakeholder workshops for farmers, researchers and extension service providers were overwhelmingly dominated by males. Developing sound REFILS programs going forward will require gender balance. The major challenge is that few females studied agriculture in general and livestock agriculture in particular. In addition to gender, age is also important. The majority of the farmers are over fifty years of age and there are not enough young farmers engaged in animal resources. With regards to researchers and extension service providers, even though the majority of them are experienced, having at least ten years and more in their respective professions, the question is whether they are able to work with each other and be trained in how REFILS should operate.

The overwhelming need seems to be the qualification and numbers of both technology developers and extension service providers. Except for perhaps Ethiopia and Rwanda, there seems to be an inadequate

number of extension workers per capita in most African countries. The problem of numbers seems to be exacerbated by the fact that some of the skilled extension workers often get promoted to administration and management jobs drawing from the already depleted corps on the ground. To try and resolve this challenge, South Africa recently announced a plan to recruit 10,000 extension workers to support the land reform program and development of new farmers. This could be an opportunity to integrate REFILS into this new program.

During the stakeholders' workshop it became clear that those extension workers and technology developers currently on the ground had inadequate skills levels. They are incapable of raising adequate awareness about the technologies which are available. This includes indigenous technologies as well which are available in abundance but tend to be ignored. Furthermore, it was apparent that they lacked capacity in the some of the new thinking in food and nutrition security, innovative use of ICT applications in agriculture, climate change, gender issues and how those impacted on REFILS.

One of the issues raised and noted by participants during the stakeholders' workshop was the fact that ministries of agriculture and other players tended to build and support capacity more in the crop sector than the livestock sector. Indeed, in many circles agriculture is actually viewed as merely crop production. This had been rectified in some countries by setting up ministries devoted exclusively to livestock e.g. Kenya and Tanzania. Furthermore, it was noted with concern that livestock farmers tended to be conservative, risk averse and were slow to adopt new technologies. This created an impediment to setting up and implementing REFILS in the livestock sector.

Some possible solutions proposed by participants included improving the capacity of the extension service providers in the field by providing in-service training courses. The effectiveness of this type of capacity building tends to be varied. Another possible solution might be to recruit extension service providers in particular at the degree level. However, if that is going to succeed then universities themselves will need to include extension service provision in their curricula. They would also need to teach the concept of REFILS itself. In addition, universities could help close the gender gap by recruiting more females into the AgriSciences field of study.

ICTs are being seen as the next best thing for agriculture. In fact ICT could revolutionize agriculture. The findings of this study indicate an increased use of ICT methods in both research and extension by both suppliers and consumers of livestock technology. There is no doubt that the COVID-19 pandemic will further accelerate the need to adopt ICTs in livestock technology development and transfer. It is imperative that all entities in REFILS i.e. farmers, researchers and extension service providers embrace ICTs and integrate them into their everyday routines.

Draft Continental Strategy

The proposed continental strategy to strengthen REFILS sets objectives, key priorities and proposes implementation mechanisms that could guide all decisions, actions, and processes for the regional organizations and member states. The continental strategy is based on the literature survey, outcomes of the questionnaire survey and the deliberations of the stakeholders' consultative workshops. The vision of the strategy is as follows

Vision

A sustainable livestock technology development, transfer and uptake system anchored by a robust REFILS in Africa.

Mission

To develop a REFILS that transforms the African livestock sector contributing to livelihoods and economic growth.

Strategic objectives, related actions and outputs

The continental strategy is underpinned by three key strategic objectives as follows

- To strengthen and grow REFILS capacity building and infrastructure support,
- To improve the REFILS policy and regulation formulation and implementation environment,
- To develop, grow and strengthen advocacy and awareness creation of REFILS.

For each strategic objective, several important result areas are identified and characterized. Thereafter, the strategic actions needed together with proposed outputs to make the identified strategy a reality are described. In addition, the responsible actors for the result areas and actions are proposed. In essence these are preconditions to the success of the implementation of each strategic objective.

Furthermore, an implementation mechanism of the strategy based on three models proposed together with implementation arrangements as well as the risks and assumptions. The implementation mechanisms are crucial in driving the strategy.

Strategic goal 1: To strengthen and grow REFILS capacity building and infrastructure support

Result area 1. Strengthening of human and technical capacity of national research and extension services (NARES)

Across the board (i.e. research, extension and farmers) the human and technical capacity of NARES has been found as one of the most important challenges. The caliber of research and extension personnel is important for the effective conduct of REFILS. Many research and extension units are understaffed or have inappropriately trained staff in their employ. Governments should therefore fill all the vacancies in research and extension and recruit appropriately qualified staff. It was recommended that the positions should be filled by persons with a minimum of an appropriate university degree qualification.

Strategic actions, outputs and responsible actors

The strategy will be accomplished through conducting of comprehensive skills audits of the research and extension divisions of livestock ministries. The outcome of the audits will indicate vacant posts and also the skills levels of those in posts. Filling of vacant posts will target the skills deficit. New recruits with specialized training in new and emerging subject areas e.g. climate change, gender, food and nutrition security which intersect with REFILS must be targeted. In addition, on the job training of those lacking the relevant skills will be done.

In recruiting new personnel, it is important to deliberately target more female personnel/experts to close the gender gap in both research and extension.

The primary responsibility of this action lies with the public sector in Member States which employs the large majority of staff in research and extension. Once the government has taken leadership, it is possible to influence other actors like the private sector and development partners to act in a similar manner through positive peer pressure. Colleges and universities should strive to enroll more females in the livestock related fields, through affirmative and deliberate action.

Result area 2. Embracing ICT and mobile technology

The COVID-19 pandemic has highlighted the possibilities and potential of what can be achieved with ICT technologies. The farmers emphasized the need to develop these technologies so that interactions between stakeholders can be done remotely and virtually. Besides overcoming barriers imposed by pandemics like COVID-19, ICTs can be used to reach many farmers who are otherwise inaccessible because of poor transport infrastructure. In addition, the use of ICT could also save departments much needed resources especially on transportation. Use of ICTs also opened farmers to many other opportunities available online.

Strategic actions, outputs and responsible actors

It is important that researchers and extension service providers are equipped with basic level of ICT knowledge. Good knowledge of ICT could be a requirement for employment. Farmers should also be trained in ICT as part of routine training in extension or at farmer field schools. Both extension services and the farmers should fully embrace ICTs for better service provision.

Moreover, infrastructure and tools for enhanced use of ICT should be provided and budgeted for in public infrastructure programs. These tools require periodic updating without which sustainable progress is not possible.

The responsible actors of this result area include Member States governments, Private sector ICT companies and tertiary education institutions. The training of graduates from higher education institutes must include all the basic aspects of ICT and its applications in livestock extension and research. Private sector companies must develop innovative ICT products in collaboration with farmers and researchers and extension agents. ICT knowledge should be a requirement for hiring workers in livestock research and extension.

Result area 3. Government budgetary allocations to strengthening REFILS

If all African governments conform to the Maputo and Malabo Declarations, then it should be relatively easy for them to allocate enough financial resources to REFILS. This will go a long way in achieving the Comprehensive Africa Agriculture Development Programme (CAADP) goals set by the continental body almost two decades ago.

Strategic actions, outputs and responsible actors

In lobbying Member states governments for increased funding to strengthen REFILS it is important for them to allocate at least 10% of the national budget to agriculture as per Maputo and Malabo Declarations. The lobbying process must emphasize the importance of REFILS in unlocking the value of livestock in national economies.

For additional funding, Member states can engage development partners and the donor community. It is important that the donors' agenda and that of the recipient countries are aligned. It is preferable that donor funding be medium to long term to achieve sustainability.

The framework and the need for funding agricultural research and extension is already in place from the continental level to the region and Member States and efforts must be expended on enforcement and implementation.

Result area 4. Developing effective cluster approaches (e.g. coops and farmer associations) to drive REFILS

Farmers should be properly organized and speak with one voice. Strong lobbying from organized farmer associations will enable farmers to sit on boards and committees which promote and implement REFILS. This will ensure that farmers are involved in technology development from the very beginning of the process thereby increasing ownership and adoption rates. Strong farmer organizations act as important lobby groups for farmer causes.

Strategic actions, outputs and responsible actors

In order to implement this strategic objective, it is vital to strengthen and empower existing farmer organizations. The action can start by auditing the existing organizations and determine their role in technology development.

Where farmers are not organized, formation of farmer unions and cooperatives should be encouraged and technical assistance to manage these organizations provided. It is important that the initiative comes from the farmers themselves otherwise there will be no buy-in.

It is important to stress that this result area should not be led by the Member states governments as is often the case. The responsible actors should be the farmers based on their needs, grievances and aspirations. The private sector can play a subsidiary role as they can use farmer cooperatives and associations as conduits for their marketing programs. The government's role should be limited to creating an enabling environment including policy and regulatory. Similarly, the RECs and continental bodies can also provide an enabling environment for the formation of transnational farmer organizations.

Result area 5. Strengthening and establishment of partnerships/collaborations of public and private sector extension services

In addition to public sector extension services, the private sector participation in research and extension is also growing as shown by the survey results and highlighted during the stakeholders' workshops. In

the light of those developments, it is strongly recommended that strengthening and/or establishment of partnerships and collaborations between public and private sector research and extension services be prioritized. This will prevent duplication of efforts and can result in efficient technology development and transfer.

Strategic actions, outputs and responsible actors

Platforms where public and public sector REFILS practitioners can converge should be created, strengthened where they already exist and promoted. This way resources can be utilized efficiently and duplication avoided. These platforms are important for coherence and collaboration between research and extension.

It is important to identify areas where the private sector can best fit in while the public sector can create an enabling business environment. There are some areas where the private sector does well and some areas where only the government can provide goods and services.

The responsible actors are the relevant government ministries in Member states and private sector companies. Where companies operate across borders the RECs and the continental body can also play a role.

Strategic goal 2. To improve the REFILS policy and regulation formulation and implementation environment

Result area 1. Formulation of regional and national policies that address technology and innovation issues with special focus on REFILS

Because of the absence of policies or legislation on REFILS in most countries on the continent, formulation of regional and national policies that address technology and innovation issues with special focus on REFILS was identified as a highest order objective. The gravity of the problem is further magnified by the fact that even more countries do not have standalone policies for research or extension. Without guidance from strong policies, the REFILS implementation will remain ad hoc and haphazard.

Strategic actions, outputs and responsible actors

A continental audit of policies on extension, research and REFILS should be done at REC and MS level. Many countries have policies on research and on extension but not specifically on REFILS. Following the audit, countries without policies should be assisted to formulate and implement policies. Countries with policies can assist those without in this regard and can also share lessons learnt and best practices. This can be coordinated by the RECs. The RECs themselves can have their own policies which can guide and must be in line with MS policies.

The responsible actors are clearly the continental body, the RECs and MS with the RECs playing a central role in the regional audit of policies.

Result area 2. Domestication and implementation of policies

One of the lessons learnt was that there is poor implementation of policies. Those countries with policies in place are not fully exploiting them. It was therefore recommended that domestication and implementation of REFILS policies by Member States be given priority.

Strategic actions, outputs and responsible actors

From the audit in strategic action 1 countries with policies will be identified. Their experiences with policy implementation will be documented and used as a learning guide. For countries not implementing policies, the reasons will be unpacked.

Incentives for policy implementation and collaboration with countries without policies will be promoted. This could be done through incentives devised by the Regional Economic Communities. Best practices and examples can be shared with other countries in the region.

This result area is the responsibility of the RECs.

Result area 3. Formulation of appropriate and supportive regulations for technology and innovation development and uptake through REFILS

While policies provide global direction of a particular sector, it is important that they be followed up by appropriate action plans and strategies. The recommendation on formulation of favourable appropriate and supportive regulations for technology and innovation development and uptake through REFILS is therefore crucial. These regulations will be specific, with detailed work plans and will include realistic timelines by which set goals will be accomplished. These regulations can be developed at both REC and MS level.

Strategic actions, outputs and responsible actors

MS and RECs must develop very detailed and specific regulations based on technology policies and strategies. The REC can coordinate development of regulations in MS and make sure there is alignment for ease of coordination and to avoid duplication. As part of the development of these regulations it is important that awareness raising be an integral part of the process.

Result area 4. Re-organization of the REFILS framework by inclusion of private sector to improve efficiency and scaling up

In many of the current REFILS the participation of the private sector is weak. Under this strategic objective it is recommended that the re-organization of the REFILS framework include increased private sector participation. This can help to improve efficiency and scaling up technologies developed in the public sector. If properly involved, the private sector can complement the public sector research and extension services. This recommendation will go a long way in ensuring that this is done in an orderly fashion.

Strategic actions, outputs and responsible actors

It is important to ensure private sector participation is not sporadic and is written into national and regional regulations. This action can tap into existing Public Private Partnerships (PPPs) already in place.

A generic structure can be created at RECs and MS level which can be used as a REFILS framework.

The primary responsibility of this action lies with MS and the private sector in those countries in creating PPP platforms.

Result area 5. Establishment of institutions to promote REFILS

In order to have strong policies and regulations governing REFILS it is important to have institutions backing it. This strategic objective calls for the establishment of institutions to promote REFILS e.g. committees, think-tanks, task forces to be involved in formulation, promotion and implementation of policies and strategies. These can be situated in reputable higher education and tertiary institutes. This will also assist in not only developing but deepening a culture of REFILS scholarship.

Strategic actions, outputs and responsible actors

It is crucial to identify appropriate institutions at MS and REC level where REFILS think tanks and policy research and extension chairs will be established.

Create regular events at these institutions where REFILS ideals are celebrated periodically.

The RECs and MS governments can identify higher education institutions and research organizations which can host think tanks, research and extension chairs and centres of excellence to promote REFILS. This way a culture of research and publication in REFILS can take root.

Strategic goal 3. To develop, grow and strengthen advocacy and awareness creation of REFILS.

Result area 1. Establishment of regional knowledge hubs and stakeholder platforms for networking and information dissemination

For REFILS to flourish and prosper, it needs knowledge hubs which continuously churn out cutting edge knowledge and evidence on best practices. This information will be appropriately packaged and disseminated by networks and relevant platforms. This is best done at the regional level coordinated by RECs.

Strategic actions, outputs and responsible actors

RECs should take the lead in identifying the best homes for knowledge hubs preferably at research institutions of higher learning. This could be accomplished through competitive bids or independent audits.

The knowledge hubs should be funded through regional competitive calls for research funding in REFILS.

Result area 2. Identification and/or creation of Centres of Excellence to model best practices and lessons learnt

Given that currently the depth of knowledge in REFILS best practices and lessons learnt is very thin on the African continent, it is important to identify existing centres of excellence or create new ones in the appointed regional REFILS knowledge hubs in result area 1.

Strategic actions, outputs and responsible actors

One of the priority tasks of the knowledge regional hubs will be to identify existing centers of excellence with emphasis on track record on work in REFILS. Where these are not in existence, new centres of excellence will be created ensuring that they will have the capacity to effectively serve the purpose.

A logical follow up action would be to provide funding to support research and outreach work on REFILS best practices through creation of dedicated research and extension chairs.

This will be the responsibility of RECs, MS and tertiary institutions. Development partners can also fund some of the research and extension services on REFILS.

Result area 3. Coordination and networking among key players in the REFILS space

It is important to form platforms which will enhance the coordination and networking among key REFILS players and stakeholders. These can be best done at the MS and REC levels. This can be achieved through establishment of knowledge hubs and centres of excellence at research institutes of higher learning.

Strategic actions, outputs and responsible actors

A key strategic action would be to create a regional REFILS platform or association which coordinates and catalogue REFILS activities in the region.

The major role of the platform or association will be to plan regular networking events like workshops and conferences on the subject matter of REFILS.

Furthermore, publishing periodic newsletters and journals on REFILS will be promoted.

This result area can be promoted from the continental body, through the RECs to the Member States and their respective higher education institutes. The private sector and development partners can fund some of the activities of the result area.

Result area 4. Establishment and/or strengthening of farmer field schools or government station for pilot studies

As a way of raising awareness on REFILS, it was recommended that farmer field schools or government stations for pilot studies be established and/or strengthened as this would stimulate generation of evidence of impact of technologies and also promote REFILS related practices like FSR-E. This is in line with the one of the strategic objectives of LiDESA. Some of the capacity building activities set in strategic objective I can be carried out at the farmer field schools.

Strategic actions, outputs and responsible actors

Establish farmer field schools in line with strategic objective I linking with the capacity building recommendations.

Encourage governments to use existing research stations for demonstration and scaling up of technologies

before they are rolled out to farmers. Farmers themselves could be involved in these actions e.g. farmer managed plots at research stations.

Link farmer field schools with government research and demonstration farms so that farmers can be involved in research and technology development from the beginning of the process.

Implementation mechanisms

Guiding principles

In implementing the strategy, stakeholders will be guided by a common vision, goals and values steeped in transparency, complementarity and collaborative accountability. The forging of partnerships with non-state actors from civil society, including gender-focused entities, NGOs and farmer organizations, private sector, state entities in research and extension given their roles and responsibilities in REFILS, is important. The need for the establishment of strong mutually beneficial networks, platforms and partnerships among the various stakeholders at national, regional, continental and international levels shaped from similar past experiences in the livestock sector cannot be overemphasized.

Implementation arrangements

The REFILS strategy must be built from the bottom up starting by building the ecosystem in member states, then coalescing efforts at regional and ultimately continental level. The role of the member states is crucial without which the implementation of the strategy will fail. In addition to providing an enabling environment, countries should invest in REFILS structures and infrastructure, develop and implement policies and strategies, develop and enforce regulations, encourage private sector and research and tertiary education institutions to participate in REFILS activities.

It is envisaged that these activities can best be achieved by MS if they adopt any of the following models.

Proposed implementation models for REFILS

It has become clear from interactions with various key informants in this assignment that REFILS is an important tool that can enhance technology development, transfer and uptake. This is a good position to start from in developing strategies to guide the continent. However, in most Member states, the platform and the related infrastructure to accomplish this goal is at best inadequate and at worst nonexistent. It is therefore important to recognize that there is no one size fits all approach as different regions have different levels of appreciation of REFILS. The regions will require different interventions. In general, Southern and Eastern Africa have a satisfactory footprint of REFILS with different levels of policy development and implementation. Western and Northern Africa have poor footprint with little infrastructure and haphazard implementation of REFILS. Central Africa is somewhere in between these two. Therefore, three models are proposed for implementation of the continental REFILS model.

I. Working within the existing system

This proposed model in many ways is a low hanging fruit. Many countries particularly in Southern and Eastern Africa, have strong research and extension divisions or departments (e.g. South Africa, Kenya,

Uganda, Malawi, Namibia, and Zimbabwe) which support livestock technology development, transfer and uptake. However, these departments generally do not collaborate well or effectively. This is despite that policies that govern their activities explicitly encourage linkages between researchers, farmers and extension service providers. In some cases, these important linkages are vaguely implied or assumed to exist. Furthermore, in some countries there are remnants of the FSR-E system which was developed in the 1980s. These include Zimbabwe, Zambia, Ethiopia, Tanzania and Malawi. This system has evolved and, in many ways, gotten entrenched within agricultural departments even though the implementation is poor because of issues of funding etc. In these countries a REFILS platform can be constituted through the establishment of a Board or a Council which will govern all the REFILS activities in the country. The Board/Council will include representatives from all key farming community members, farmers, researchers and extension services. In addition, the private sector and development partners must also be included. This is similar to the system currently in operation in Rwanda. Ideally this platform should be created by an Act of parliament so that it has proper legal standing. The Board or Council can develop the relevant REFILS policies and strategies for the country.

The costs of setting up this model are minimal as members of the platform are drawn from existing senior government civil servants and employed representatives from farmer organizations and development partners. A relevant government department can provide the secretariat for the platform.

2. *Merging the departments*

The second proposed model is to merge the divisions or departments of extension and research into single units. This is an attractive model but has a few pitfalls that need to be ironed out before successful implementation can be achieved. Often, the merging of departments excludes the farmers and other key stakeholders in these merged units. For these units to deliver optimal REFILS, key stakeholders like farmer organizations, development agencies and the private sector must be involved. It is proposed therefore that within the new merged research and extension department include a unit for farmer outreach and engagement.

One of the biggest potential drawbacks for this model, is that the merged unit is driven by the public sector and can easily be adversely affected by bureaucratic challenges. In addition, bringing together key players under one division does not necessarily mean they will be able to work collaboratively together. The merging of departments of extension and research must be followed by extensive and inclusive discussions where the rationale, objectives and new structure of the new department are discussed and agreed upon. If the majority of the players buy into the new structure then the chances of successfully rolling out and implementing REFILS are high.

The new flat structure must remove hierarchy and flow of information must be across all the units i.e. research, extension and farmer outreach and engagement. The processes of technology development, transfer and uptake must be fully owned by all three components of REFILS. Joint establishment, cooperation and collaboration must be the centerpiece of how the new department operates.

The requirement to merge departments is not always evident because of the politics involved and the fear

at the personal levels that restructuring may result in job losses, redundancies or re-alignments. This model can also be promoted as part of facilitating the Maputo and Malabo Declarations and related CAADP objectives. Often, the opportunity only arises when new governments come into power with sweeping new agendas, as was the case in Rwanda. In this model, the fear of job losses may be ameliorated by the fact that a new farmer unit will be created. In addition, some of the staff can be moved to the field where there is a massive shortage of extension personnel. The net result may be that there will not be many new costs or savings in setting up this model. A few specialist staff may need to be hired for the new stakeholder outreach and engagement unit.

There are examples of countries which have merged their research and extension services before. In Zimbabwe the merging of these two departments was not properly implemented. There was no buy-in from the two departments before they were merged and they still competed rather than complemented each other. The model only looked at the research and extension units and did not include other key stakeholders like the farming community, development partners and the private sector. Gambia also attempted to merge their research and extension divisions without much success for similar reasons.

3. *New approaches*

In many African countries government structures on REFILS are either absent or operating sub-optimally. Poor governance and lack of political will is one of the major constraints of REFILS. At the same time many governments depend on aid to run their agricultural programs. Therefore, government can appoint a REFILS coordinating unit with a clear mandate to work with the various donor and aid agencies in developing and implementing projects and ensure that local research, extension and farmers are involved in examining the technologies brought into the country or those developed locally. This will ensure that local technologies or those from elsewhere which are not appropriate are not imposed on the local animal resources sector.

Development partners should also have officers responsible for REFILS within their staff establishment to ensure that the technologies they advocate for have local application and are likely to be adopted and utilized. Furthermore, these partners should be encouraged to use REFILS approaches when implementing their programs. The ACIAR project cited above is a good example of how this model can be successful.

4. *Combining the three approaches*

In some countries the preconditions for the three approaches described above are available. In such cases any of the three approaches described above can be combined. For example, many countries in Africa receive some form of aid from development partners and a number of these countries, particularly in sub-Saharan Africa have conditions that would suit the first approach of working with the existing system. In these donor-dependent countries, it could therefore, be ideal to combine approach one and approach three with remnants of the FSR-E system.

Roles and responsibilities of AU, RECs, MS and other stakeholders in implementing the strategy

The African Union Commission (AUC) through the Department of Agriculture, Rural Development and Blue Economy (DARBE), AU-IBAR and the Member States, will own the strategy. AU-IBAR will be responsible for the overall coordination of the strategy at the continental level. AU-IBAR will also be responsible for monitoring the implementation and reporting to stakeholders on behalf of AUC. AU-IBAR will also assist with capacity building, technical back-stopping of RECs. Member States will be responsible for the implementation of the strategy.

The RECs and other regional institutions will be responsible for the regional coordination of policies and strategies, promotion and establishment of regional infrastructure and support to MS and Regional stakeholders' organizations. This requires regular consultation and sharing of information on REFILS. The RECs will showcase good examples of REFILS projects, highlight best practices from countries performing well and encourage others to emulate them. This could be done through regular regional stakeholders' consultative workshops with expert facilitators on REFILS to guide the deliberations. Where feasible, exchange visits by REFILS staff could be organized between countries for look-and-learn experiences.

Member States are ultimately responsible for the implementation of the strategy, therefore, they must create enabling environments for REFILS to work. This entails an environment with good policies, strategies and good governance. Furthermore, MS should make sure that REFILS is implemented by staff with the requisite capacity and expertise. Where necessary, regular refresher training of staff should be conducted. Member States should commit to avail the necessary budgetary allocations. The framework for budget allocations to agriculture research and extension has been set by the African Union in collaboration with the Member States. All that remains is for national governments to implement.

Other stakeholders involved in REFILS will promote the implementation of the strategy of REFILS, it is important to advocate for, raise awareness of REFILS and improve networking and building capacity of implementing stakeholders. International organizations including United Nations (UN) agencies e.g. Food and Agricultural Organization (FAO), and International Livestock Research Institute (ILRI) and international development partners and donor agencies will provide technical support through secondment of experts, training and capacity building for MS, RECs and AUC institutions according to their respective mandates.

Conclusion

If the Malabo Declaration is fully embraced and implemented by the AU member states, and LiDESA is implemented, then the livestock sector in Africa will be transformed and poised to grow significantly in the long term. This growth will put pressure on the industry to adopt tools like REFILS which can support technology development, transfer and uptake. In this action the status of REFILS on the African continent was examined. Even though there is a general agreement on the suitability of REFILS as a tool in livestock development, its proper utilization by Member States is generally poor. The policy environment is poor with very little to guide stakeholders involved in REFILS. There is a strong gender imbalance and lack of skills within the stakeholders involved in REFILS. Important lessons learnt were drawn from past and present experiences in REFILS which will be crucial in guiding the way forward.

A draft continental strategy is proposed. The strategy is underpinned by a vision and mission together with three strategic objectives, action plans and possible outcomes. The strategic objectives are: to strengthen and grow REFILS capacity building and infrastructure support; to improve the REFILS policy and regulation formulation and implementation environment; and to develop, grow and strengthen advocacy and awareness creation of REFILS.

Three models are proposed for the implementation of the continental strategy. These include working within the system with existing resources to form a coordinating Board or platform that brings together all the key stakeholders; merging departments or divisions of research and extension to form a new department with a stakeholder engagement unit to make sure all players are catered for; and a third model which coordinates all technology development from development partners to make sure the correct and appropriate interventions are extended to the livestock farmers.

An implementing mechanism with a strong ecosystem built from the member states going up to the Regional Economic Community and the African Union Commission is proposed. The implementation is guided by transparency, collaboration, mutual respect and complementarity.

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Appendixes

Appendix I. Questionnaires used for the survey.

1. Researchers' perceptions of the Research-Extension-Farmer Linkage Systems (REFILS) for increased technology development, transfer and uptake in Africa. <https://docs.google.com/forms/d/1vwpU4Vj-oe2Ouwti7Pfrv8PvKjO592s-9DuTlWtWofU/edit>
2. Farmers' perceptions of the Research-Extension-Farmer Linkage Systems (REFILS) for increased technology development, transfer and uptake in Africa. https://docs.google.com/forms/d/19M4k6ZkFOhr5C_6iWjB6mm-7EiGw0QSRsOzhsVXZ3m0/edit
3. Extension service providers' perceptions of the Research-Extension-Farmer Linkage Systems (REFILS) for increased technology development, transfer and uptake in Africa. https://docs.google.com/forms/d/1mOjwXHg-tpb9iDx5_0-A78AOHXjt6A6buaS5U_2qk18/edit

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