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ABSTRACT

The challenges of food security and agricultural development in South Africa cannot simply be solved by limiting extension and research development to the public sector. However, if shortcomings arise in the public sector while addressing extension, research and development, the potential involvement of the private sector is increased. The current lack of public and private partnerships (PPPs) in extension, research and development increase the difficulty of solving the food security challenges in South Africa. The current study investigated the role of extension and research as processes for the development for sustainable food security, and the need for developing PPP's in South Africa. The study is based on a comprehensive theoretical review of available literature and government policies. Analysis of the data collected revealed that the improvement of agricultural production, with the goal of sustainable food security, in South Africa, might not be achieved without an effective agricultural extension service that is strongly linked to research. It was also found that public sector extension work is a necessity for the growth of the industry, but is limited by inadequate resources, bureaucratic work and the multidimensional work requirements. A need has been identified by the government to encourage the participation from the private sector in agricultural extension and research development.

Keywords: Food security, development, extension, research, public-private partnerships

1. INTRODUCTION

The South African government has applied various strategies to address poverty and food insecurity within the country, but these approaches have not yet yielded positive results (Department of Agriculture 2002; Altman, Hart & Jacobs, 2009). The public-sector research and extension systems in South Africa, is entrusted with the delivery of public goods and services at all levels (Department of Agriculture, 2005). As in an increasingly turbulent environment, the public sector has lately been experiencing a bumpy road to make progress, as its tasks seem overwhelming and beyond human capacity to perform satisfactorily. The public sector is often associated with inefficiencies and the inability to meet rapidly growing market demands, but as a result the contribution of the traditional public sector is largely being questioned. The results suggest the need for a major overhaul when considering the involvement of sectors regarding extension and development systems. It has become clear that in this day and age, the involvement of the public sector alone is not sufficient to address multi-faceted problems that South African producers are confronted with (Phuhlisani, 2008).

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The public sector is constrained by limited resource availability, with agricultural extension in particular being constrained by a wide range of role players (farmers and extension personnel) and the added responsibility of handling emerging issues such as administration related challenges, marketing and agribusiness. The future goal is to involve various stakeholders in agriculture in the development process, and strengthening the existing public-private partnerships (PPP's) in extension. Outside the public domain, vast potential financial resources exist with a whole universe of talent and wisdom which can serve the farmers in a meaningful way (The World Bank, 2011). The task of managing research and extension in South Africa in the future cannot be addressed by the public sector alone, but will require the combined strength and synergies of a pluralistic, multi-agency system in which the private sector, farmer organisations, cooperatives, NGO's, para-professionals, small agribusiness, self-help groups, input dealers and suppliers, electronic and print media and information technology will each contribute according to its own strength and capabilities. There is a necessity to harness all possible resources, including both human and financial, potential for the big task to provide services to the farmers. Participation of these organisations in providing research and extension services, will naturally benefit farmers by using new technologies, cultivating "cash crops" to maximise their profit and also help scientists to transfer the technology to the rural population.

Regardless of the potential benefits that can be gained from combined synergies, there is a lack of PPP's in extension, research and development to tackle the food security challenge in South Africa, according to Christoplos, 2010; Naseem et al, 2010; Department of Agriculture, 2008; 2001; Mitchel & Fakisandla Consulting, 2007; Nieuwoudt & Nieuwoudt, 2004; and Rivera & Qamar, 2003. The challenges of overcoming service backlogs, meeting developmental goals and encouraging economic growth while promoting food security in South Africa result in the development of new and creative mechanisms for extension and research systems. Partnerships between government, the private sector and even a segment of civil society are viewed as an important method of working towards meeting various developmental and service delivery goals within the country (Mitchell 2008). These partnerships need to be explored as they have the potential to ensure food security in South Africa.

This paper focuses on the need for PPP's in extension, research and development for increased food security in South Africa. It is not a comprehensive analysis of public and private sector investments in extension, research and development, but rather represents information that demonstrates the need for PPP's, with particular emphasis on South Africa. To achieve the main objective of the current study, available literature was reviewed to address four fundamental questions:

- (a) What is the role of agricultural extension and research for development in sustainable food security?
- (b) What is the nature and extent of private extension in South Africa?
- (c) What is the nature and extent of private research for development in South Africa?
- (d) Why is there a need for PPP's in extension and research for development in South Africa?

The answers to these questions provide a foothold for decision-making by government donors and investors, as well as aid in the development of effective strategies and policies implemented for agricultural growth. The next section of this paper provides insights on the PPP's in South Africa.

2. BACKGROUND OF PUBLIC-PRIVATE SECTOR PARTNERSHIPS IN SOUTH AFRICA

South Africa, as noted by Fombad (2014), has joined other nations around the world in resorting PPP's as an integral strategy to improve its deeply rooted socio-economic, political, fiscal and societal problems and to meet the pressure of attaining the goals set for national and international development projects. A PPP is according to the National Treasury PPP Unit (2007), defined in South Africa law as a contract between a government institution and private party, where the private party performs an institutional function and/or uses state property in terms of output specifications (Touche, 2006). Substantial project risk (financial, technical, and operational) is transferred to the private party. The private party then benefits through unitary payments from government budgets and/or user fees.

Since 1999, PPP's in South Africa have been formed between the government and its associated private sector partners to enter into mutual beneficial commercial transactions for the public good. The country has progressively increased the number of PPP transactions covering a wide range of sectors, including transport, office accommodation, healthcare, eco-tourism, social development and correctional services (National Treasury PPP Unit, 2007). The main objective of these PPP's is to ensure the delivery of needed services (better services) by utilising private sector expertise and transferring risk to the private sector. The PPP's are alternative service delivery arrangements in comparison to traditional public service delivery services. The main legislation governing PPP's at national and provincial levels of government according to the National Treasury PPP Unit (2007) is the Public Finance Management Act (1999) and Treasury Regulation 16. Municipal PPP's are governed under the Municipal Finance Systems Act (2003).

While there has been an increase in the number of PPP's in South Africa over the past years, the question has been asked whether these partnerships have been successful or not. According to Crauser (2003), recent years have seen a marked increase of cooperation between the Public and Private sectors concerning the development and operation of environmental and transport infrastructure in South Africa. While initial projects have often been limited to the water and road sector, with the construction of toll roads (representing clearly defined financial returns), there is a growing acceptance that PPP arrangements can also be used to meet service needs in a wide variety of other sectors. The research conducted by Kaiser Associates Economic Development Practice (2005) has indicated that South Africa's PPP framework, is in most aspects, on par with global best practice when prioritising project sectors such as health and infrastructure. However, there are discrepancies in the PPP sector of South Africa, as many projects and initiatives are still in the early stages.

3. MATERIALS AND METHODS

This study is a result of a thorough literature study (both national and international) compiled on agricultural extension, research and development, to increase food security and identify the need for PPP's in South Africa. The literature review was conducted by using Google scholar search engines as a data collection methodology. The results were based upon qualitative data derived from secondary sources, involving a discussion of relevant literature found from previous studies, books, administrative records and reports, placing the primary focus on South Africa.

4. RESULTS AND DISCUSSION

4.1 The role of agricultural extension in sustainable food security

Food security is still a great concern for many households in South Africa. Currently, although South Africa has been identified as the second largest economy in Africa with an adequate food supply at a national level, constant food security has not been transferred on a household level (Shisana *et al.* 2014). Recent statistics gained from Shisana *et al.* (2014), show that 45.6% of South Africans are food secure, 28.3% are at risk of hunger, while 26% are food insecure (experience hunger on a daily basis). This situation is connected to the high level of poverty that exists in the country, particularly in rural areas (Abdu-Raheem & Worth, 2011). Establishing food security, particularly household food security, is as described by Abdu-Raheem (2013), widely acknowledged as an important milestone in advancing the living standards of the rural poor population. One avenue that can be taken toward realising this is through acknowledging smallholder agriculture. This statement is supported by RSA (2014) cited by FAO, IFAD & WFP (2014) which said that in the endeavour to increase food security and meet Millennium Development Goals (MDG's), South Africa's programmes and interventions are strongly foregrounded in agriculture, elsewhere around the globe.

As South Africa becomes more conscious of the need to combat household food insecurity and rural poverty, the practice of agricultural extension emerges as a potentially powerful vehicle to achieve this. One important way of supporting agricultural development is through agricultural extension programmes. Agricultural extension is, broadly defined as the process of development of agricultural knowledge and skills amongst farmers, aimed at increasing their productivity and realising other desirable changes (Collett & Gale, 2009). Agricultural extension has changed in definition and purpose over time. Recently, extension has been defined as “systems that facilitate the access of farmers, the organisation and other market actors to knowledge, information and technologies; facilitate their interaction with partners in research, education, agribusiness and other relevant institutions; and assist them to develop their own technical, organisational and management skills and practices” (Christoplos, 2010:3). This definition suggests that the relevance of extension moves beyond the traditional transfer of information, knowledge and technology from researchers to farmers to include developing capacity, skills and effective management techniques amongst farmers and farming communities. The traditional role of technology transfer to producers is non-existent according to Chikaire *et al.* (2011), since it has not met the changing nature of agriculture and the farming community. The approaches and roles utilised have changed dramatically to reach and impact people.

Extension service delivery must shift from its current top down approach to a knowledge sharing and facilitated learning approach. In this case, extension workers regard their clients as partners in the development of new skills, and generating innovations rather than assuming the farmers to be mere recipients of externally generated scientific knowledge which may or may not be suited to their livelihoods and farming context. Extension should promote social capital amongst farming households. This will enhance farmers' capacity to manage their farming operations more effectively and efficiently (Abdu-Raheem, 2013). The current research-extension linkage is however weak and is, according to Munyuwa *et al.* (2002), an institutional problem yet to be resolved. Investigating and institutionalising linkages with other institutions is a strategy that extension organisations in South Africa can use to keep up with current new information. The same challenge is also evident in various parts of the world such as China and India (Joshi *et al.* 2015) and Nigeria (Olatunji *et al.* 2015).

There is no doubt that public agricultural extension has contributed to the success of South Africa's current large-scale farms. Nonetheless, the effectiveness of the extension service to meet the current challenges, particularly amongst resource challenged smallholder farmers, is widely acknowledged amongst role players (Abdu-Raheem, 2014). According to Abdu-Raheem (2013), agricultural extension could help address food security by focusing on enhancing agricultural productivity and profitability. It is vital that agriculture remains an integral part of the government strategy to address food insecurity. Agricultural extension programmes should be re-examined and adjusted so that they are able to make contributions towards creating and maintaining food security.

4.2 The role of agricultural research for sustainable food security

It is a great challenge to feed nine billion people in the world, and this challenge requires changes in agricultural production in terms of high yields, adaptation of cropping systems to climate change, genetic improvement of plant varieties, pest management and the implementation of new farming practices (Stefanis, 2014). The South Africa Agricultural Research Council (ARC) has since its establishment in 1990, conducted research aimed at improving agricultural productivity and contributing to improved food production and food security (Agricultural Research Council (2014/2015). History demonstrates that science and technology may contribute to huge increases in yield (Stefanis, 2014; Beddington, 2010). A multitude of approaches and technologies have a potential to contribute towards achieving the long-term goal of sustainable food security (Beddington, 2010). The development and/or improvements to support smallholder/subsistence agriculture require substantial or improved investments and support into research and other agricultural services (Baiphethi & Jacobs, 2009). According to the South Africa Trust (2009), agricultural research has made significant advances in developing improved agricultural technologies for production suited to the soil and climate conditions of South Africa. This is particularly important for the smallholder (subsistence) agricultural sector of South Africa which contributes immensely to household food security (Vink & Kirsten, 2013; Thamaga-Chitja & Morojele, 2014). However, the agricultural sector is faced with many challenges that can benefit from agricultural research. These challenges include the adaptation to effects of climate change, farming within environmental limits while surviving economically, access and use of agricultural technologies and access to agricultural markets.

In the face of climate change, appropriate agricultural research is necessary to enable information generation on the adaptation and resilience strategies which can be implemented to sustain food security (Qureshi *et al.* 2015; McKersie, 2015). Through research, appropriate policies can be generated that ensure effective pricing systems of agricultural produce, access to available land and the development of rural infrastructure for agricultural purposes. To ensure sustainable food security, there is a need to continuously improve the tools and techniques available to producers working in diverse environments with varying methods. This involves developing new technologies, but also includes adapting already established technologies to be effectively utilised by producers.

4.3 The nature and extent of private extension in South Africa

It is estimated that only five percent of the world's agricultural extension services are provided by private institutions (Anderson & Feder, 2007). This is due to the common pool of good characteristics of private extension, which makes pricing difficult (Poulton & Macartney, 2012). Despite the complexity of this sector, private extension plays a huge role

as a complementary structure to public extension service or government extension service. This is particularly true for a country like South Africa which has a dualistic agricultural sector composed of smallholder and large-scale farmers (subsistence and commercial farmers).

South Africa has three major agricultural development goals at the national level, which according to Van Niekerk *et al.* (2011), determine the activities of agricultural extension in South Africa. These are to achieve national food security, improve rural livelihoods, and improve resource management. The named activities are required by the government extension service to reach these goals, requiring the active participation of the government extension services.

Agricultural education institutions are also potential advisory service providers. However, the role of universities and other agricultural education institutions in providing extension services has been limited, including collaborative activities with NGO's and private providers (Koch & Terblanché, 2013). Commodity orientated extension or technical assistance is also growing through private companies and through some government and private joint ventures. A very good and successful example of a joint venture is that formed between South African Sugar Association (an industry-based private entity) and the Department of Agriculture and Environment Affairs for smallholder sugarcane growers in South Africa (Rivera & Alex, 2004). This public-private joint venture offers opportunities to provide services to small farmers, while linking them to viable market opportunities. This initiative serves the interest of the industry and helps the government to meet important social objectives. The identified public-private joint venture has a bright future, as it is a way of expediting service delivery to smallholder farmers who need a service for which they are unable to pay. This joint venture should be considered a prime example of a successful strategy that can be incorporated in the design of a national model of an extension model that can serve the smallholder farmers in South Africa (Rivera & Alex, 2004).

With sufficient funding, many private sector firms can organise, manage and deliver extension services more efficiently than government agencies. The 'traditional' home of agricultural experts in South Africa has been in higher education institutions and the government. However, increasingly more individuals have left these institutions and have set up private consulting and/or service providing businesses which offer a wide range of agricultural related services, including technical production advice, marketing, infrastructure development (for example irrigation), business management and research (Liebenberg, 2015). According to Liebenberg (2015), the following organisations and businesses are potential partners in the overall extension strategy of South Africa and their inclusion needs to be deliberately considered:

- Commodity Organisations: About 33 commodity organisations currently exist in South Africa. They provide services like producer representation industry promotion, information sharing, quality assurance, industry transformation, and research. Some of these organisations have well established farmer support programmes aimed at new entrants to farming and have become preferred service providers to departmental farms settlement programs.
- Organised Agricultural Organisations: Four institutions exist within this sphere, namely, AgriSA, The Transvaal Agricultural Union (perceived to be solely focused on commercial Agriculture), the National African Farmers Union (NAFU) primarily focusing on black stallholder farmers, and the African Farmers Association of South Africa (AFASA). These organisations serve as the mouthpiece for farmers at national

level, with the purpose of ensuring the best possible financial and social position for the farmer within the national economy.

- Non-Government Organisations (NGO): In South Africa, there are 16 NGO's focusing on agriculture; 23 on rural development; and 10 that deal with land issues. The services provided by these institutions generally range from skills development to legal support. As it stands, these organisations could serve as an additional source of scarce capacity.
- Private Consultants: This category consists of individuals, associations and companies. The scope of their services is diverse, ranging from input supply to agricultural and rural development support. These consultants could serve as a rich source of partnerships available to extension services.
- Agri-business and Banks: Another source of support to farmers is commercial banks and agri-business industries. Commercial banks have well established agricultural divisions dedicated to providing financial support to commercial farmers, but at commercial principles. Although banks do not promote themselves as extension providers, they do possess the potential to assist in the provision of access to technical support to their clients. The Agri-business sector provides technical support services to commercial farmers. All the major commercial banks have an agricultural division specialising in tailor made financial services to the farming community. These include specialist services from agricultural economists and advisors ranging from support in development of business plans to insurance services. Land Bank, in particular, provides financial support to emerging farmers. The Department of Agriculture Forestry and Fisheries (DAFF) also provides financial assistance through a programme called MAFISA. A second program of DAFF offers grants to support short term operating expenses and small operating needs such as machinery. It targets a similar group of beneficiaries as MAFISA.

4.4 The nature and extent of private research and development in South Africa

Munyuwa *et al.* (2002), noted that farmers, universities and colleges, private organisations and non-governmental organisations are not fully acknowledged in practice as potential information sources by extension organisations in South Africa. Any existing relationships amongst extension and these institutions have been informal and indirect. These institutions are however rich in knowledge and information. They also provide dynamism in information generation that can greatly enhance agricultural extension information needs, subsequently improving services provided to farmers, contributing to sustainable food security. Extension organisations, research institutions, farmer groups/organisations and universities are all stakeholders in the extension, research and educational process.

The following facts have been extracted from a study undertaken to assess Private Sector Agriculture Research and Innovation in South Africa as indicators of the extent and nature of private research and development in South Africa (Kirsten *et al.*, 2010):

- The South African public research network is the largest in Africa even though it is under serious pressure. The pressure comes in the form of serious funding shortages which has resulted in poor management and loss of research expertise. This has impacted on the quality of research produced by the public sector. Consequently, provisions of research have shifted more and more to the private sector, largely because the public system could not deliver on the demands of primary and secondary agriculture.

- Agricultural Research and Development is increasing its engagement of the private sector in terms of funding and the actual execution of research globally. This is also the case in most developing countries, such as Brazil, India, Columbia and Mexico who have restructured their policies to encourage private sector participation in agricultural research and development. Similarly, South Africa has also increased privatisation of agricultural research.
- Agricultural research is dominated by the private sector in South Africa. However, there is no available data to quantify to what extent, due to the limited number of institutions carrying out such statistical research.
- There are very few policies influencing participation of the private sector in South Africa's agricultural research and development. The major policies are the deregulation of the agriculture input and product markets as well as the liberation of agricultural trade.
- Most private agriculture firms import technology developed by foreign companies as opposed to being innovators of their own local technology. This is because the firms have partnerships with foreign multinational companies and operate as subsidiaries of these foreign companies. This impacts negatively on the country's economy. In addition, imported technology is not usually suitable for the local environment.

4.5 The need for public-private partnerships in extension and research for development in South Africa

4.5.1 The need in extension system

Extension programmes in South Africa lack a coherent link, both with their producers and with the agricultural research sector. The private sector has become an important alternative to public extension in providing technical inputs, information, training and organisational support services to farmers and rural households (Abdu-Raheem, 2014).

Extension leaders in South Africa cannot ignore the interdependent economic and social environment where the emerging roles of the private sector are becoming well organised and appreciated. Failure to do so would result in the further deterioration of extension programmes and undermine long-term credibility of extension systems. To continue with a "business as usual" attitude could put extension in direct competition with the private sector (a struggle that extension is unlikely to win) (Christoplos, 2010). Instead, extension leaders need to determine how public extension and private extension sectors can work together in a partnership that will serve long-term societal interests. Pluralism, as opposed to a single dimension strategy, should be adopted in organising extension programmes in South Africa (Koch & Terblanché, 2013).

Furthermore, in view of the challenges facing farmers in South Africa today, the structural transformation of agricultural extension systems is unavoidable. South Africa needs to pursue greater involvement by the private non-profit and for-profit sectors as means of improving the effectiveness and sustainability of agricultural extension systems. Public extension should not view the private sector as a threat, but as possible opportunities to forge new partnerships. The private sector can provide extension services more efficiently and effectively than the public sector agencies. These advantages increase the likelihood of long-term and sustainable services (Alex *et al.* 2004).

Over the past decade, public investment in agricultural research has lagged compared to other sectors. The agricultural sector faces monumental challenge such as food insecurity. The solution to this challenge seems veiled in the complexity requiring greater collaborative research efforts and partnerships, as well as optimal utilisation of limited resources (Department of Agriculture, Forestry & Fisheries, 2008). Moreover, the National Agricultural Research and Development Strategy (Department of Agriculture, Forestry and Fisheries, 2008) in South Africa calls for a stronger collaborative effort and partnerships in agricultural research for development. Originating from this strategy will be the development of a national agricultural research agenda with broadly defined stakeholder inputs.

According to the Department of Agriculture, Forestry and Fisheries (2008), collaboration and partnerships amongst research organisations are important for the growth of the industry. There is an array of actors and potential players in agricultural research and development, each with their own mandates, strengths, and weaknesses. The promotion of partnerships and collaborations amongst these organisations should be guided and sustained.

4.6 The roles of private and public sectors in partnerships

South Africa, like other developing countries, has joined other nations around the world in resorting to PPP's as an integral strategy to improve its deeply rooted socio-economic, political, fiscal and societal problems. The public and private sectors in South Africa have complementary roles to play in a PPP (Fombad, 2014). PPP's enhance service deliveries through partnerships between the public and private sectors while achieving their goals to the benefit of everyone in the country (Nsasira *et al.*, 2013).

4.7 The benefits of public-private partnerships

Research partnerships in South Africa can lead to food insecurity solutions. They can improve local agricultural practices and develop stable production of crops that are more nutritious, better adapted to local growing conditions and resistant to pests. PPPs can help farmers gain greater access to fundamental resources so that they can manage their production process more reliably, at less cost and with greater certainty. Successful PPPs can also:

- improve the efficiency of developing locally (adapted innovation),
- enable technology to be distributed more effectively to local farmers,
- help farmers continuously improve and make the most of sustainable agricultural practices,
- promote the effective and responsible application of new technologies, and
- provide social and economic value to farmers and communities.

By working together through PPPs, these two sectors can bring together the necessary experiences, knowledge, investment, technologies, and resources to address agricultural issues which may have been overlooked by a single-sector programme or approach. Capacities to identify opportunities, develop common interests, and negotiate commitment are pre-requisites for a successful PPP. Yet, many PPPs fail due to the lack of both skills amongst the partnering agents and effort to strengthen these skills.

4.8 The challenges of public-private partnerships

Successful PPPs are certainly emerging in South Africa. However, the picture is much more complex and the prevalence of these arrangements are less than expected (Kaiser *et al.*, 2005). Developing a successful PPP programme is a complex undertaking and involves a number of key challenges to be addressed (World Bank Group, 2014). Various generic problems emerge that relate firstly to forming partnerships between public and private sectors, and secondly to operating together in a partnership framework.

Some of the problems are a result of the bureaucratic nature and procedures of the public sector which is limiting and inflexible in nature. Considering that this challenge has been around for decades, there is a need for the government to review some of their operational procedures in light of their impact on government clientele. Difficulties experienced are also as a result of different working styles and reward structures of private and public extension systems (National Treasury PPP Unit, 2007). In addition, the public sector lacks business culture and has limited experience of working in commercial settings with no experience of working with the private sector or even in partnerships. Partnerships often fail due to a lack of trust between the public and private sectors. To combat these challenges, both parties need to be flexible and willing to meet each other halfway so that they all meet their objectives. For example, the public sector could accept reduced profit margins whilst the public sector could play a more active role in expense incurring activities in a partnership (Support Program for Accelerated Infrastructure Development–SPAID, 2007; Mitchell, D & Fakisandla Consulting, 2007).

Expenditure by the private sector has increased and will remain important in performing agricultural research. However, to ensure sustainability and efficiency of this framework, collaboration between the public and private sectors, between international organisations and the private sector; as well as between private firms will be crucial. The government must also play its role in providing an enabling environment for private sector research by addressing some of the policy concerns encountered by the private sector (Kirsten, Choolwe. & Ruan, 2010).

5. CONCLUSION

The study revealed that:

- Both public and private extension and research sectors have significant roles to play in order to sustain food production in South Africa. These roles include generation of appropriate and timely information and technology.
- Public-private partnerships constitute a new mode of operation in many fields of development, including agricultural extension and agricultural research. These are increasingly being emphasised as an effective mechanism to improve public service provision and implementing development programmes in South Africa.
- The potential for public-private sector partnerships in South Africa is expected to grow.
- South Africa has the largest research network in Africa, but its once prestigious public research systems has come under extreme pressure as a result of funding shortages and poor management, as well as a loss of research expertise.

6. RECOMMENDATIONS

Based on the findings of the current study, the following recommendations can be put forward:

- South African agricultural extension service and research for development are challenged to improve food security and it is therefore vital that agriculture and agricultural research remain an integral part of the government strategy to address food insecurity and poverty at household level. Agricultural research and extension institutions can bring an increase in production, however, these institutions cannot operate in a vacuum, irrespective of how good they may be. There are various prerequisites for research and extension to operate successfully. Firstly, there needs to be government commitment to agriculture and agricultural research and extension. This assumes that economic policies will be supportive of agriculture and the institutional environment must be supportive of research and extension. Secondly, public research and extension should not work in isolation. Closer working relations between research and extension organisations should therefore be encouraged to reach every farmer seeking facilitation.
- Considering the current poor reach of extension and the limited investment in extension, South Africa needs more public-private partnerships with better coordination amongst them. Some of the public funding should be used to expand pluralistic extension arrangements by way of contracting and developing joint programmes. Public extension should take lead in connecting these different extension providers and enabling effective communication that can foster partnerships. Identifying potential partners and developing working relationships amongst the different agencies should be the main task of extension managers at the provincial, district and local levels. Development of extension policies and operational guidelines to promote pluralism and partnerships at the state level would go a long way in reforming extension and enabling PPPs.
- Public agricultural extension services in South Africa is forced to adapt to new funding constraints and a changing agricultural sector. The extension services need to change from being a unified public-sector service to that of a multi-institutional network of knowledge and information to support rural people. This implies that the government need to act to redefine extension and implement a coherent extension policy to advance a pluralistic system of extension providers. Since rural knowledge and information requirements are diverse, there are various benefits from having a range of providers to delivering advice, technology and innovations, and facilitating services. Such a strategy requires new mechanisms for financing or co-financing public good services and most importantly, requires mechanisms for enhancing the quality of services provided by diverse institutions. In pursuing such a strategy, the government requires a better understanding of existing extension services and a design of extension policy which is supportive of a pluralistic system. It is also necessary that they conduct an inventory of actors, for instance, who provides what to whom, as well as an assessment of the quality of the services rendered before deciding on any reform.
- Institutions such as commodity organisations, financial organisations, academic institutions, research institutions, farmer organisations and other NGO's should, as stated in the Department of Agriculture, Forestry and Fisheries Strategic Plan for Smallholder Support 2011-2014/15, participate in the development and support of smallholder producers through provision of linkages and technical support.

- The study recommends that in order to ensure sustainability and efficiency of private sector research, collaboration between the public and private sectors as well as international organisations will be crucial.
- In recommendation, the South African government needs to encourage increased participation by the private sector in agricultural extension and agricultural research for development. There should be a growing awareness, in both the public and private sectors, of the significant benefits that can be derived from such collaborations.
- Moreover, if public-private sector partnerships are to fulfil their potential in South Africa, new ways must be found to break down barriers and increase communication and trust between the two sectors.

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