

**ANALYSIS OF STAKEHOLDERS' COLLABORATION IN  
AGRICULTURAL INNOVATION SYSTEMS IN THE NORTH - WEST  
PROVINCE, SOUTH AFRICA**

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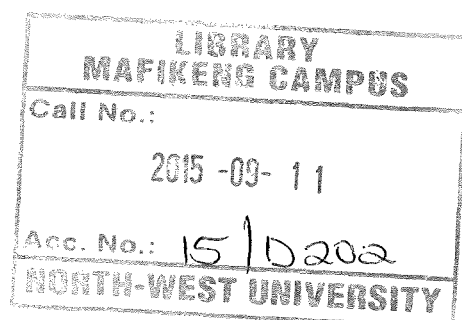
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## DECLARATION

I declare that this thesis hereby submitted in fulfillment of the requirements for the degree of Doctor of Philosophy in Agriculture (Extension) in the Department of Agricultural Economics and Extension, School of Agriculture, Science and Technology at the University North West University, Mafikeng Campus, is my own independent work and has not been submitted at any another university. I further declare that all materials contained herein have been duly acknowledged.

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S. Modirwa

## ABSTRACT

The aggravation of global food insecurity and greater food price volatility provide an opportunity to strengthen collaboration among stakeholders in agricultural innovation systems in order to accelerate the adoption of sustainable agricultural strategies. Innovation systems are established to facilitate open communication among various stakeholders to promote collective collaboration. The concept of innovation system as a strategy of entry point for institutionalisation, operationalisation and dissemination of agricultural technology have received a lot of attention in recent times. However, successful collaboration ultimately rests upon the commitment of individuals and the willingness of these individuals to work together and “collaborate” with one another. Limited information exists on the factors that influence the willingness of stakeholders’ collaboration. This study examined collaboration among researchers, extension agents, farmers, input dealers and marketers of agricultural innovation in the North West Province of South Africa. A total sample size of 205 respondents made up of 50 researchers, 60 extension agents, 30 input dealers, 30 marketers and 35 farmers were selected for the study. The study identified the characteristics of stakeholders involved in the agricultural innovation system in the North West Province.

Data was collected through a structured questionnaire on personal characteristics of farmers, extension agents, researchers, input dealers and marketers of agricultural innovation system in the North West Province on the extent of existing collaboration, linkage activities to collaboration, constraints hindering their collaboration and knowledge of agricultural innovation systems. The data was subjected to analysis using the Statistical Package for Social Sciences (SPSS). Descriptive statistics such as frequency distribution, percentages, mean and multiple regression analysis were used for analysis.

The results revealed that gender has an influence on the adoption of agricultural innovation in the North West Province; farming decisions are dominated by men rather than women, extension agents (65%), researchers (68%), farmers (51%), input dealers (73%) and marketers (70%). Furthermore, Linkage activities for collaboration ranked high by extension agents are knowledge generation (92%), joint implementation (90%) and in Management (88%), evaluation trials (80%). Farmers also indicated their involvement in joint seminar and workshops (98%), joint demonstration (98%) and problem diagnosis (97%). Researchers stated their participation in knowledge dissemination (84%), joint seminar (72%), joint field visit (68%), both problem diagnosis and field days (66%).

Marketers were involved in both joint training and planning (87%), problem diagnosis (83%) evaluation reports (73%), management (73%) and sharing of resources (70%). Input dealers were involved in joint feedback (67%), demonstration (60%) and knowledge generation (57%). Prevailing constraints to collaboration indicated by almost all respondents were: Inadequate research staff (98%), poor administration (93%), job tenure of extension agents (90%), lack of communication among stakeholders (88%) and professional bias (85%).

Multiple regression results showed a strong correlation between independent variables and collaboration. One way analysis of variance showed difference in linkage, attitude and knowledge of Agricultural Innovation System among marketers, researchers, input dealers, farmers and extension agents. The results indicated that there is a weak linkage between stakeholders. To make the value more effective, operative linkage among researchers, extension agents, farmers, input dealers and marketers are recommended in the study.

Key words: Stakeholders, Agricultural Innovation, Innovation systems approach.

## **DEDICATION**

This study is dedicated to my husband, Jake, my children, Bonolo and Boipelo. I have learned much from you and owe you a lot in return. May the love of God continue to shine in your hearts as my love.

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## **ABBREVIATION AND DEFINITION OF ACRONYMS.**

AIS	Agricultural Innovation System
CASP	Comprehensive Agricultural Support Programme
LRAD	Land Redistribution for Agricultural Development
ARC	Agricultural Research Council
OECD	Organisation for Economic Co-operation and Development.
GDP	Gross Domestic Product
DAFF	Department of Agriculture, Forestry and Fisheries
NARI	National Agricultural Research Institute
FO	Farmer Organisation
NGO	Non-governmental organisations
SPSS	Statistical Product and Service Solution
AFASA	African Farmers Association of South Africa
NWERPO	North West Emerging Red Producer Organisation
NAFU	National African Farmers Union

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background to the study

Agriculture is an important sector in economic development and poverty alleviation; it represents an important yield to the national economy and rural livelihoods (Stands, Rooizitalab and Beintema, 2008). Despite the role it plays, its productivity in sub-Saharan Africa has deteriorated, and the reasons for the stagnation among others, include inadequate returns from research and development efforts (Jones, 2009). Jones further states that even though agricultural research has generated numerous kinds of technology with high potential, the impact of technology has never improved farmers' production as well as their economic well-being. To increase agricultural production in order to meet the growing population requires a sustained innovation system whereby research, extension, education, input dealers and other organizations collaborate their efforts in the innovation process in order to stay competitive in world markets (World Bank, 2009).

Agwu, Dimelu and Medukwe (2008) emphasises that many innovations have resulted in the sharing of knowledge, information and resources among stakeholders. Thus, innovation system replaces a change from linear model of research and development. The World Bank (2006b) defines innovation system as a network of organisations and individuals focused on bringing new products and new forms of organization into economic use, together with their institutions and policies that affect their performance. The World Bank (2011) adds that innovation system is influenced by enabling conditions rather than mere research and technologies. Leeuwis (2010) further states that innovation system is not only based on insights from scientists, but also from users and other societal agents. Thus farmers' involvement in the initial stage of innovation development is an important factor for sustainable agriculture in the North West Province.

Adekunle and Fatumbi (2012) assert that multi-stakeholder collaboration has found prominence among policy makers and it is being explored as an approach to enhance agricultural production systems. It is promoted as a measure of increasing the availability and usability of knowledge among actors to achieve the vision of agriculture as a driver of food

security, environmental sustainability and economic opportunity. Turpin and Fernandes-Equinas (2011) argue that multi-stakeholder collaboration is very common not only in development science but also in basic fundamental science. According to Sorensen and Torfing (2012), so far, there have been few attempts to relate these fields of interests and bodies of literature by analysing how interactive arenas can facilitate multi-actor collaboration that in turn may foster innovation by bringing together public and private actors with relevant innovation assets, facilitating knowledge sharing and transformative learning, and building joint ownership to new innovative visions and practices. Despite extensive investigation on the contingencies of multi-stakeholder collaboration, Andrews and Entwistle (2010) and Provan and Kennis (2008) found that little has been paid to the structural aspects of collaborative arrangements, and a series of questions about effective network structure remain unanswered in the field of agricultural research and development. Volker, Probst and Cristinc (2006) emphasise that through collaboration, the strength of one group would compensate for any constraints and limitations of the other group. Aref (2010) add that without collaboration in development programmes and decision-making, there will be no innovation.

The South African government has prioritised support programmes such as the Comprehensive Agricultural Support Programme (CASP), the Land Redistribution for Agricultural Development (LRAD) and the Micro-Agricultural Finance Initiative of South Africa (MAFISA) in order to enhance agricultural performance. The agricultural production system in the North West Province consists of the Agricultural Research Council (ARC), which represents the research sub-system, farmers' producer organisations, agricultural input dealers, marketers, the directorate of extension services in the department of agriculture, forestry and fisheries which provide extension services for farming communities, the North West University, Faculty of Agriculture, Agribusiness and other Agricultural Research Institutions. It is from all these stakeholders that linkage activities are coordinated and agricultural decisions made. However, the Department of Agriculture, Forestry and Fisheries (DAFF, 2009) noted that collaboration between the said stakeholders need to be promoted in order to focus on innovation and adaptive research.

According to Leeuwis (2010), stakeholders collaborate through activities such as helping find advice, funding and support for innovation outcomes. Furthermore they need to be involved

in the production, packaging, distribution and consumption of agricultural produce. However, innovation communication and adaptation of new ideas for the current practice are also important. According to Swanson and Rajalahti (2010) and Rivera and Sulaiman (2009), extension services provide information, advice and education in many facets of rural life and improvement. Thus extension and advisory service were born out of the need to assist and disseminate new agricultural innovation for farmers. According to Tachner and Fiedler (2009), stakeholders are categorised according to their relative importance.

## **1.2 Problem statement**

An agricultural innovation system is a complex set of functions and linkages. To increase agricultural production to meet the needs of the growing population requires a sustained innovation system, whereby research, extension, education, farmer organisations, input dealers and other organisations collaborate in the innovation process (World Bank, 2009). The Department of Agriculture Forestry and Fisheries (DAFF, 2009) maintain that there is weak collaboration among the Agricultural Research Council, University faculties of Agriculture, Provincial Departments of Agriculture, Agribusiness and other Agricultural research institutions. Also, Smith, Avila and Abdi (2004) report that there is no linkage between research institutions and extension agencies.

This poor inter-organisational relationship between extension agencies and researchers gives a clear indication that the adoption is poor because the technologies do not meet the needs of farmers (Rusike, Twomlow and Freeman, 2006). The South African government has introduced support programmes to assist stakeholders to share their efforts in promoting agricultural. Despite the linkage mechanisms by the government, the problem of weak linkages and collaboration among stakeholders still exists. To examine these problems, the aim of this study is to explore how linkages, partnerships and other forms of interaction between different stakeholders can accommodate the development and implementation of new and bold ideas in ways that reinvigorate agricultural production. South Africa is in the process of transformation in the sense that every aspect of the society is changing. Therefore, support to farmers should also change and rather be collaborative in implementing new ways that reinvigorate agricultural production. In order to cater for the challenges of transformation, it is of vital importance to investigate the following questions:

- What are the characteristics of stakeholders involved in AIS in the North West Province?
- What collaboration exists between stakeholders in North West Province?
- What linkage activities exist among stakeholders in the North West Province?
- What are the constraints to stakeholder collaboration in the North West Province?
- What are the attitudes of stakeholders towards collaboration in the North West Province and
- Are stakeholders in the North West Province aware and knowledgeable about the Agricultural Innovation System?

### **1.3 Research objectives**

The main objective of the study was to analyse stakeholders' collaboration in the agricultural innovation system in the North West Province, South Africa. The specific objectives of the study were to:

- Identify the characteristics of stakeholders for Agricultural Innovation System in the North West Province;
- Examine linkage activities among stakeholders;
- Identify constraints to collaboration among stakeholders;
- Determine attitude towards collaboration among stakeholders; and
- Examine knowledge of Agricultural Innovation System among stakeholders.

### **1.4 Hypothesis**

1. There is no significant relationship between the socio-economic characteristics, constraints, attitude, knowledge and collaboration among farmers, researchers, extension agents, input dealers and marketers and collaboration for agricultural innovation system in the North West Province.
2. There is no significant difference in linkage, constraints, attitude and knowledge among researchers, extension officers, farmers, input dealers and marketers for agricultural innovation system in the North West Province.

## **1.5 Significance of the study**

The present study is intended to reveal the extent of collaboration that exists among farmers, extension agents, researchers, input dealers and marketers for agricultural innovation system in the North West province. It provides an opportunity to express their views and also divulge their attitude towards collaboration. Constraints towards collaboration are understood; understanding the constraints and further determining their attitude to collaboration among stakeholders will facilitate efforts by policy-makers to institutionalise collaboration among stakeholders involved in innovation system. In addition, this study reflects on how farmers, extension agents, researchers, input dealers and marketers link with one another in agricultural innovation systems and how these links could be improved in order to ensure that innovations are relevant and adopted by end users.

## **1.6 Thesis outline**

Chapter one provides the background of the study, introduces the problem that triggered the study and its contribution to the advancement of knowledge on collaboration existing among people or the province at large.

Chapter two presents the literature relevant to this study. It analyses the agricultural innovation system and explains how agricultural innovation system occurs. It also outlines the structure of agriculture and extension in South Africa. The chapter also describes the stakeholders involved in agricultural innovation system and further highlights approaches used in agricultural innovation system as well as providing examples of linkage activities in different countries.

Chapter three describes the methodology, method used in collecting data from farmers, extension agents, researchers, marketers and input dealers within the North West Province and from different organizations. It also outlines the technique used in analysing the data.

Chapter four presents the socio-economic characteristics of farmers, extension agents, researchers, marketers and input dealers using the data collected from 35 farmers, 60 extension agents, 50 researchers, 30 marketers and 30 input dealers. The information also

covers linkage activities, constraints to collaboration encountered by respondents, their knowledge of agricultural innovation system and their attitude towards collaboration.

Chapter five presents the major findings, conclusions and recommendations for future research opportunities identified during the process of the study.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

This chapter reviews literature based on the objectives of the study. It starts by analysing agricultural innovation system. It provides the structure of extension and agriculture in South Africa. Furthermore, it identifies and explains the different stakeholders involved in the agricultural innovation process; stakeholders are important for the success of agricultural development. It highlights the approaches used in agricultural innovation system. Lastly; it provide examples of linkage activities in other countries.

#### 2.2 Analysing agricultural innovation system

Innovations of agricultural suppliers, producers and retailers are directly or indirectly shaping sustainability within the agro food-web. If sustainable innovations are targeted, the key challenges faced by agriculture worldwide, such as food security, climate change, should be promoted. Knowledge about current innovation processes is needed to reveal mechanisms that allow for promoting sustainable agricultural innovations (König, Kuntosch Bokelmann 2012).

Innovation is defined differently by different authors. Anandajayasekeram (2009), defines it as “the technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first commercial use of a new (or improved) process or equipment”. Innovations are new creations of economic significance. They relate to the production of new knowledge and/or new combination of existing knowledge. The critical point to note is that this knowledge cannot be regarded as innovation unless it is transformed into products and processes that have social and economic use. The use of the term innovation in its broadest sense, covers the activities and processes associated with the generation, production, distribution, adaptation and use of new technical, institutional and organisational, managerial knowledge and service delivery (Hall, Mytelka and Oyeyinka, 2005). On the other hand the World Bank (2012) defines innovation system as the process by which individuals or organizations master and implement the design and production of goods and services that are new to them. However, the World Bank (2006b) adds that it is a network of organisations, enterprises and individuals focused on bringing new

products, new processes and new forms of organisation into economic use, together with institutions and policies that affect their behavior and performance. According to Rivera (2006b), AIS differs from other systems because it caters for value chain, market and supply chain development accentuating on high value products and export markets.

A system is a collection of related elements that must function in concert in order to achieve a desired result. It consists of interlinked subsystems. A system contains one or more feedback loops which are central to the system behaviour and permits a system to function in a self-managed, self-sustained way. The two key conclusions emerging from the systems thinking are that the interrelated parts drive the system and the feedback loops are circular rather than linear. The systems' thinking is not new to agriculture. The earliest work in systems has its roots in the early 20th century. Its systematic application in the agricultural sector began in the mid-20th century. The application of the 'systems' concept in agricultural and Rural Development started with the farming systems research to address the farm level productivity constraints in the 1970s. Nowadays the use has expanded to the application in organization and institutional analysis, resulting in the 'agricultural innovation systems' concept (Ponniah and Berhanu, 2009).

Agricultural innovation system occurs through dynamic interaction among the multitudes of actors involved in growing, processing, packaging, distributing and consuming of agricultural products. These actors have different skills, therefore, interaction among them needs to open and draw upon the most appropriate knowledge. The ability to innovate is related to collective action, coordination and the exchange of knowledge among multiple actors, the incentives and resources available to form partnership and develop business and conditions that make it possible for farmers to use the innovation. Research, education and extension are not enough to bring knowledge, technologies and service to farmers and get them innovate. Innovation requires a more interactive, dynamic and flexible process in which actors coordinate their efforts with various conditions and complementary activities that go beyond extension. The Agricultural Innovation System caters for various conditions and relationships that promote innovation in agriculture, considers diverse actors, their potential interaction in promoting innovation. Agricultural Innovation System supports research, extension and education and create links among extension and farmers for innovation to take place (World Bank, 2012).

The importance of promoting agricultural innovation system is that it builds on local knowledge and resources, which results in ownership and continuity of initiatives, while addressing the priority needs of beneficiaries or communities for improved livelihoods. PROLINNOVA (2005) asserts that in order to improve livelihoods, aspects such as labour, knowledge and local management capacities that enable people to skilfully manipulate local resources for their own benefits are necessary.

The agricultural innovation system approach allows for collaboration and communication among stakeholders, which is subsequent to social learning. Stakeholders are able to identify and recognise their experimentation efforts, responsibilities, strengths and weaknesses, thereby strengthening participation and community innovation processes. Opondo, Zake and Stroud (2005) note that the agricultural innovation system approach has been, among others, adapted to integrated soil and waters conservation, integrated pest management and Farmer Field School approaches and thus, there is higher adaptation of technologies by farmers. On the other hand, other stakeholders learn from farmers about their farming systems and about the actual constraints and potentials of the communities.

### **2.3 The structure of agriculture and extension services in South Africa**

South Africa is one of the largest countries on the African continent. It occupies 1.22 million of the surface area with a population of 46.9 million. It has varied climatic regions ranging from Mediterranean to sub-tropical and semi-arid that allow for a diversified agriculture, mainly consisting of field crops, horticulture and livestock as the main sectors (Organisation for Economic Co-operation and Development, 2006). The country is self-sufficient in most major agricultural products, and in years when rainfall is plentiful, the country becomes a net food exporter of crops such as sugar, citrus, grapes, maize, cotton, tobacco and wine. Even though the country is still a net agricultural exporter, the ration of agriculture exports to the country's total export is low. According to Kirsten, Doward and Vink (2009), South Africa's primary agriculture accounts for less than three percent of the country's Gross Domestic Product and about ten percent of employment. However it is observed that agriculture has backward and forward linkages into the economy. The Department of Agriculture, Forestry and fisheries has been involved in improving agricultural production and minimising the cost

of input of farmers. Liebenberg and Pardey (2010) indicate that the productivity of the agricultural sector has been fluctuating. Conradie, Piesse and Thirtle (2009) remark that it became stagnant due to declining output growth and increasing use of inputs around 2008.

Land redistribution is well advanced, with more than 60% of claims settled and more than 900 000 hectares of agricultural land restored to their former owners. Some 35 % beneficiaries opted for compensation in cash, which contributed to poverty alleviation sectors (Organisation for Economic Co-operation and Development 2006). Restitution beneficiaries invested in home improvements, education and other livelihood projects. Land redistribution is aimed at providing people with access to land for either settlement or agricultural purposes. The aim is to settle small and emerging farmers on viable farming operations in commercial farming areas. The programme aims to transfer thirty percent of agricultural land belonging to white owners to previously disadvantaged individuals. Contrary to land restitution, the land redistribution programme performed below target due to insufficient financial resources and lack of agricultural support services and collaboration. Improved extension services have been identified as one of the major ways to improve farmers' livelihoods.

Agricultural extension in South Africa has undergone a fundamental change from a dualistic service (separate services for commercial and small-scale farmers) to a single combined service, focusing on the needs of both previously disadvantaged small-scale farmers and large-scale commercial farmers. The introduction of democracy in South Africa in 1994 brought about fundamental changes in the policy, administrative and delivery mechanisms and systems for government services to conform to the new Constitution. The department of agriculture, Forestry and Fisheries in South Africa designed mechanisms for broadening access to agriculture for previously disadvantaged farmers in terms of their needs for financial services, human resource development, technology development, marketing services and broadening access to agricultural extension and advisory services. However, the agricultural extension service presents serious problems interms of efficiency and relevance (Department of Agriculture, Forestry and Fisheries 2005).

Provinces have a responsibility to strengthen their extension services, but are currently experiencing constraints and pressures on their ability to provide effective extension and advisory services to farming communities. A participatory approach was therefore

recommended for South Africa in extension project planning, extension linkage and coordination, knowledge support, education and training, and monitoring and evaluation for the effectiveness of advisory service and extension programmes to be relevant to farmers' needs. The agricultural sector further recommends equitable access and participation in a globally competitive sector for strong extension and advisory service led by government's operations in partnership with relevant role players who contribute to community development, income generation, employment creation, food security and better life for all in a sustainable manner. In developing countries, the top down approach followed in rural development failed and a more participatory approach in which farmers decide which changes are desirable is recommended to enhance sustainable rural development Department of Agriculture Forestry and Fisheries (DAFF, 2005).

## **2.4 Stakeholders' involvement in innovation process**

Stakeholders can be at any level or position in society, from the international to the national, regional, household or intra-household level. Stakeholder collaboration is currently being promoted as a way to improve agricultural production. Swanepoel and De Beer (2006) define a stakeholder as an individual or organisation that has an interest in an activity or a project. The current innovation landscape in South Africa is characterised by myriad institutions with the responsibility of improving agricultural production. Such institutions include the Agricultural Research Council, agricultural universities, farmer organisations, agricultural extension and non-governmental organisations.

### **2.4.1 Agricultural research**

According to the World Bank (2006), research is the main driver of innovation, creating new knowledge and technology that can be transferred and adapted to different situations. Its central role is to provide effective solutions or responses to the major constraints of agricultural and rural development, such as those related to policy and institutional issues, those related to technical production, productivity enhancement, resource management or utilization, and those related to the social and economic problems such as access to land, water, and other required inputs (Smith *et al.*, 2004). This means that through research, the

lives of people, especially of the poor in most developing countries, can be improved dismally (Spielman & Grebmer, 2004).

Spielman and Grebmer (2004) further clarify that research also contributes to the augmentation of agricultural productivity, output and quality, to improvement in sustainable use of natural resources, to lower consumer prices for food, and to the accumulation of physical and human capital among poor or vulnerable agrarian agents and households. Such improvements can certainly improve the income of the poor, have a positive impact on food consumption, better nutrition, and favourable changes in the allocation of individual and household assets.

Agricultural research can thus be summed up as a unit that can address two sets of problems. Those related to the competitiveness of agricultural commodities in domestic and global markets and those related to the quality and maintenance of natural resources. It is an essential tool for a sustainable agricultural development programmes in both developed and developing countries of the world (Oladele, 2008).

Greater emphasis should therefore be put in to research as it is essential to maintain the sustainability of agricultural production and economic development (DAFF, 2005). Unfortunately, in Africa, research has not impacted much on production, hence its priorities and methods have been widely critiqued and the relevance of its outputs has also been questioned (Sumberg, 2005). Smith, *et al.* (2004), point out that researchers do not always work in coordination with farmers hence there is lack of technology adoption and the utilisation of research in agricultural systems is minimal. This leads to most of the research outputs being literally shelved in mountains while they remain unutilised simply because the large amounts of information ends up being tied up in journal publications targeted towards peer-groups or colleagues rather than farmers who rarely have access nor understand such publications.

Another critique of research is that most institutions like universities and research institutes innovate in isolation and even though research is conducted in so many different organisations nationally and internationally, its coordination is dysfunctional and poorly linked to the production sector (Agwu, Morlai and Egbule, 2011). These institutions should rather work in a coordinated manner and conduct researches for technology development and transfer and not only for journal reviews (DoA, 2005).

Oladele (2008) concludes that it is imperative that research be intelligently mobilised and its outputs and technologies effectively disseminated because the dissemination of research results keeps people thinking about research and also allows them to be familiar with the technologies and to easily accept the need for further research work. Hence, research must be given great attention and wider competencies, linkages, enabling attitudes, practices, governance structures and policies should be wisely developed in order to allow research findings to be put into productive usage (World Bank, 2006).

#### **2.4.2 Agricultural universities**

Agricultural universities play a role in training agricultural specialists, researchers and extension specialists and in conducting research. These trained agricultural workers disseminate agricultural technologies for adoption to modernise the agricultural sector. Short and executive courses organised by these universities for policy-makers and participants in the agricultural sector helps in expanding the knowledge base in agriculture and rural development and improves the performance of the sector. Through collaboration with policy-makers universities improve policy environment for agriculture. Information provided by universities through research contributes to evidence-based policy formulation which most of the time tends to be pragmatic. The expertise available in the universities is often brought to bear on the development of national agricultural development strategies. Universities also take part in monitoring and evaluation of agricultural projects and programmes to ensure that they meet their objectives (Asenso-Okere and Braun, 2009).

Agricultural universities also have a direct role to play in poverty alleviation for the mere fact that the majority of poor people live in rural areas and education is a key factor in reducing the level of poverty. In this context, collaboration between universities and rural development is crucial. Atchoachera (2004) adds that in the context of globalisation, universities need to look beyond the provision of agronomists. However, Juma (2012) notes that there is a separation between universities and research. This separation is a major obstacle to innovation. The creation and implementation of agricultural universities require a cadre of people with expertise in innovation management. This can be achieved through executive education offered to high level leaders responsible for policy promotion as well as implementation of agricultural innovation system.

Juma further states that challenges faced by African agriculture will require fundamental changes in the way universities train their students. It is notable that most African universities do not specifically train agriculture students to work on farms in the same way medical schools train students to work in hospitals. Part of the problem arises from the traditional separation between research and teaching—the former is carried out in national research institutes and the latter in universities. National Agricultural Research Institutes operate a large number of research programmes that provide a strong basis for building new initiatives aimed at upgrading their innovative capabilities. In effect, what is needed is to strengthen the educational, commercialisation and extension functions of the NARIs. More specifically, clustering these functions would result in dedicated research universities whose curriculum would be modeled along full value chains of specific commodities. For example, innovation universities located in proximity to coffee production sites should develop expertise in the entire value chain of the industry. This could be applied to other crops as well as to livestock and fisheries. Such dedicated universities would not have a monopoly over specific crops but should serve as opportunities for learning how to connect higher education to the productive sector. The new universities need to improve their curricula to make them relevant to the communities in which they are located. More importantly they should serve as critical hubs in local innovation systems or clusters.

### **2.4.3 Farmer organisations**

Farmer organisations exist because farmers have recognised the need and benefits of being organised for a particular purpose. Organisations are created through the initiative of farmers themselves. Farmer organisations are membership based. They used to be rooted in traditional societies, managed the relationships of their members within the society and mainly focused on redistributing resources such as access to land and labour, organised savings and credit associations and securing basic conditions for sustainable farming. However Heemskerk and Wennik (2005) observe that modern farmer organisations manage relationships with institutions outside the traditional society. Of course, agricultural innovation system is an interactive, multi-actor process that cannot be achieved by farmers alone. It requires farmer organisations and other institutions. Knowledge of these key

elements allows defining the roles of public and private sectors for innovation service providers.

#### **2.4.4 Agricultural extension**

Extension can be defined as a systematic process of working with farmers in order to assist them in acquiring relevant and useful agricultural knowledge and skills with the mandate of increasing farm productivity, competitiveness and sustainability (DoA, 2005). Ashraf, Muhammad and Chaudhry (2007) contend that extension is a centre of information for both researchers and farmers because it exposes farmers' problems to researchers and also provides the research findings back to farmers. Adisa (2011) remarks that agricultural extension plays a substantial role in agricultural and rural development as it facilitates the diffusion process of agricultural technologies and innovations among farmers in order to improve their production levels and income. Thus, the ultimate objective of extension is to improve the living standards of farmers, farm workers and their families. To achieve this objective, extension workers need to know about new things and ways that work for the different people of their area and have solutions to their constraints and new opportunities for more income, more food security and employment (Prolinnova, 2007).

In most countries, agricultural extension involves quite a number of various activities in both the public and private sectors but, information exchange is the most important out of all these extension activities. Public agricultural extension structure consists of professional agricultural experts who are generally government employees. These experts are liable to teach improved methods of farming, demonstrate innovations, and organise farmer meetings and field days on a wide range of topics. Public extension is sometimes also used as a channel to introduce and implement agricultural policies.

Agricultural extension, or agricultural advisory services, involves all organisations that support people engaged in agricultural production and facilitate their efforts to solve problems; link to markets and other players in the agricultural value chain; and obtain information, skills, and technologies to improve their livelihoods (Birner, Davis, Pender and Nkonya 2009). Farmers need a wide range of information in order to be successful in their farm enterprises such as market demands for their products, access to credit and loans and

time to buy inputs and sell produce. It is the role of agricultural extension to provide such assistance to farmers.

#### **2.4.5 Non-governmental organisations**

A non-governmental organisation is a locally constituted organisation created by natural or legal persons that operate independently from any form of government (Ramakrishna, 2013). The term is normally used to refer to organisations that are not part of the government and are not conventional for profit business. In cases where they are funded totally or partially by the government, it maintains its non-governmental status by excluding government representatives from membership of the organisation. They are organised interest groups that operate singly or in combination with one another to promote their causes (Baride, 2013). Swanepoel and De Beer (2006) note that they came into existence to address farming methods to rural farmers at grassroots, focus on various types of extension work, the distribution of agricultural inputs, increasing agricultural production and food security. Siddaraju (2010) adds that they play a role in promoting and implementing different development activities. NGOs are very prominent and effective in implementing Sustainable Agriculture Development programmes. Thus, they are prominent in the effective implementation of government programmes towards sustainability of agriculture and in influencing awareness programmes and marketing facilities. Agricultural and rural development strategies benefit from increased collaboration between non-governmental and extension organisations. Therefore, government should take more interest and improve agriculture with the help of NGOs. In this direction, the government should give support to NGOs.

#### **2.5 Approaches used in agricultural innovation system**

The approach is the style of action within a system and exemplifies the philosophy of a system. Ponniah, Puskur, Workneh and Hoekstra (2008) note that an approach is like a doctrine for the system, which informs, stimulates and guides aspects of the system as its structure, its leadership, its programme, its resources and its linkages. The following are extension approaches:

### **2.5.1 Ministry- Based General Extension**

Extension was operated in the typical civil service style involving excessive bureaucracy and red-tapes. Decision making was highly centralised with farmers contributing little or nothing to programme development. The organizational structure operated was such that the lines of communication were very long such that farm information was distorted before reaching the village level. Ineffectiveness of extension services reflected in extension consisting routinely of the provision of supplies and services while the education functions were ignored (Ladele, 2008)

### **2.5.2 The general agricultural extension approach**

The aim of this approach is to increase farmers' production. According to this approach, technology and knowledge are relevant for the local people but are not being utilised. This approach is government controlled and planning is done on national level by the government. This approach is a reflection of a top-down approach. The personnel here are high in number and costly, and the government bears the costs. The adoption rate or important recommendations and an increase in national production are the measures of success. Agricultural extension was part of the Department of Agriculture. There is a single way of communication in this approach, hence only farmers who seek advice or large scale wealthier farmers benefited. Thus, the provision of information to farmers based on production varieties is from one source.

### **2.5.3 Commodity specialised approach**

A significant distinction of this approach groups all functions for increased production – extension, research, input dealers and marketers are under one management. Extension is oriented to one crop or commodity and the agent performs many functions. Planning is controlled by a commodity organisation for the purpose of increasing production of a specific commodity. Practices recommended must be demonstrable on farmers' own fields and produce financial benefits for farmers. New inputs must be accessible, a credit scheme established, and the ratio between farm-gate inputs and commodity prices considered. Technology tends to be relevant and distributed timely. The interests of farmers however, have less priority than the commodity production of organisation.

#### **2.5.4 Training and visit approach**

This is one of the best known approaches which was adopted in East African countries to enhance extension service delivery. This approach provides continuous feedback from farmers to extension agents and to research staff, it allows for continuous adjustment to farmers' needs. It had spread rapidly around the world because it is seen as an effective means of increasing farm production and a flexible tool to all levels under the department of agriculture. Its purpose is to introduce farmers to increase production of specific crops. The approach is based on planned schedule to visit farmers and training extension agents as well as subject matter specialists. Close links are maintained between research and extension. Success is measured in terms of production increases of the particular crops covered by the programme. The emphasis is on disseminating low cost improved practices, and teaching farmers to utilise available resources effectively. Field extension staffs are sent to meet farmers in their farms and this puts pressure on the government in terms of logistic support. This is little flexibility and lack of two way communication. Extension staffs are trained every fortnight on relevant extension problems and the staffs extends these messages to farmers. Field days are arranged on the farms of contact farmers for their neighbours to also benefit from what they have learned. This gives a little room for benefits from technologies due to the limited knowledge and skills of these contact farmers.

#### **2.5.5 The farming systems development approach**

This approach assumes that the technology that meets the needs of small scale farmers needs to be generated locally. The significant characteristic of this approach is its holistic approach at the local level. Planning advances at a slow rate and may be different for each agro – climatic farm ecosystem. The approach is implemented through partnership of research and extension agents using a systems approach. Technology is developed locally through an interactive process involving local people. Analyses and field trials are conducted on farmers' farm and homes. The measure of success is the extent to which farm people make total adoption of technologies developed by the programme. Local farm families, extension officers and research control the programme. The advantage of this approach is that there is a strong linkage between extension and research personnel, and the commitment of farmers of using technologies developed based on their needs.

### **2.5.6 Farming systems/participatory methods**

This emerged due to the fact that small scale farmers did not adopt technologies developed on research stations. To address this problem, it was then decided that research activities should address farmers' needs. Also, farmers need to partake in the development of technologies. Thus, farming systems is a holistic approach that looks at the entire farm as a system. It enhanced linkages between research, extension and farmers. Participation of these stakeholders in the development of technologies allowed farmers to influence direction and execution of development projects with view of improving their economic well-being.

### **2.5.7 Participatory Extension Approach (PEA)**

Agricultural extension services link research workers, policy makers and other providers of support services with farmers. They play a role in providing innovative knowledge as well as feedback. With the realisation of the need for empowerment, local ownership and the diversified approach to service provision, the role of the traditional public sector extension services is gradually changing. The extension staff, rather than being mere agents for concepts or technologies imposed from outside, need to become facilitators, helping communities achieve distinct goals. This section describes a Participatory Extension Approach (PEA). However, PEA is included with other extension approaches but is specific with respect to extension to be integrated within the Farming Systems approach.

Characteristics of the participatory extension approach

The main characteristics of PEA are as follows:

- It integrates community mobilisation for planning and action with rural development, agricultural extension and research;
- It is based on an equal partnership between farmers, researchers and extension agents who can all learn from each other and contribute their knowledge and skills;
- It aims to strengthen rural people's problem-solving, planning and management abilities;
- It promotes farmers' capacity to adopt and develop new and appropriate technologies,
- It encourages farmers to learn through experimentation, building on their own knowledge and practices and blending them with new ideas, in other words, 'action reflection' or 'action learning'; and
- It recognises that communities are not homogeneous but consist of various social groups

with conflicts and differences in interests, power and capabilities. Each group then makes its collective decisions and also provides opportunities to negotiate between groups.

The role of extension is to facilitate this process. Good extension work means talking with farmers, working with farmers, learning from farmers and suggesting new approaches to farmers.

#### **2.5.8 The project approach**

This approach focuses on a particular location, for a specific time period, often with outside resources. This approach demonstrates techniques that could be sustained after the project period. It uses large infusions of outside resources for a few years to demonstrate the potential of new technologies. Control is at the central government level and there are often considerable financial and technical inputs from an international development agency.

#### **2.5.9 The cost sharing approach**

This approach is based on local people sharing part of the cost of the extension programme. Its purpose is to provide advice and information to facilitate the self-improvement of farmers. It assumes that cost-sharing with local people (those who do not have the means to pay the full cost) will promote a programme that is more likely to meet local situations and where extension agents are more accountable to local interests. Control and planning is shared by various entities and is responsive to local interests. Success is measured by the willingness and ability of farmers to provide some share of the cost, be it individually or through local government units. Problems may arise if local farmers are pressured into investing in unproven enterprises.

#### **2.5.10 The educational institution approach**

This approach uses educational institutions which have technical knowledge and some research ability to provide extension services for rural people. Planning is controlled by those determining the curriculum of the educational institution. Implementation is through non-formal training, either in groups or individuals through a college or university. Attendance and the extent of participation by farmers in agricultural extension activities are the measures of success. Ideally, researchers learn from extension agents who, in turn, learn from farmers.

However, this rarely occurs in practice. The advantage of this approach is the relationship between specialised scientists and field extension personnel.

## **2.6 Linkage activities in different countries of the world**

### **2.6.1 Indonesia**

The department of Agricultural Research and Development administers research institutes on behalf of the national Ministry of Agriculture. There are no research centres operating at provincial level. The agricultural extension service is controlled by the Department of Agricultural Extension, under the Department of Agriculture. The Department of Agricultural Extension supervises extension services at all levels through regional offices and works in collaboration with the heads of districts and villages. As part of the Department of Agricultural Extension, the Agricultural Extension and Information Centre operates at district level. At the sub-district level, is the Agricultural Extension Centre with about ten to twenty field extension workers attached to each. The Rural Socio-economic Research Centre is responsible for monitoring all on-farm experiments in the regions and provinces. These on-farm experiments are conducted by the Assessment Institute for Agricultural Technology at provincial level, and by the Agricultural Technology Assessment Place at village level. Adaptive research work is done with subject-matter specialists in order to develop technology packages which are then passed on to extension centres. The assessment Institute for Agricultural Technology thus exists as a linkage interface between research and extension organisations. The Agricultural Extension Centres, subject-matter specialists and researchers all serve as sources of research needs, but only national researchers make final decisions to select research problems. The Agricultural Extension Centres receive innovation packages from research centres through subject matter specialists. Although there is collaboration between national research staff, extension agents and farmers at the provincial level, this collaboration has not led to final decisions on linkage activities being controlled at the provincial and district levels: the management of agricultural research–extension linkages depends mainly on Agricultural Research and Development-supervised institutes and is still largely a top-down approach it is a nationally controlled research–extension linkage system in which decision-making is concentrated in the hands of national officers, and Agricultural Extension and Information Centres and national research centres are unequal in status (Agbamu, 2006).

### **2.6.2 Japan**

The national government in Japan does not offer extension services; agricultural research–extension linkage operates at the state level. It is a bottom-up approach system in which decisions on linkage activities are taken at the state level without the direct involvement of national officers. Research–extension linkage involves the use of subject-matter specialists, technical committees, joint study meetings, and staff exchanges between state or government research and extension organisations. Farmers’ problems and needs are identified by district extension centres from farmers, agro-cooperative societies, schools, and town/village administrative offices. Local needs identified by extension agents are supplemented with those identified by researchers and subject-matter specialists. Thus, the problems/needs of farmers are finalised at state level by a committee involving researchers, administrators, subject-matter specialists, extension workers, farmers’ organisations and knowledgeable persons. Although national officers are not directly involved in this process, they make input by putting forward unresolved research themes that have been referred to them and by highlighting policy directives on research themes from the National Ministry of Agriculture, Forestry and Fisheries. The Japanese research–extension system is a bottom-up approach (Agbamu, 2006).

### **2.6.3 Mexico**

The seven main agricultural research institutes and eight regional experimental stations in Mexico fall under the authority of the Federal Secretariat of Ranch, Agriculture & Rural Development. The university-based National Agriculture, Livestock and Forestry Research Institute is the key organisation in the promotion of research–extension linkages at national level. It forms one of the seven main institutes and has offices in each government department for networking with local extension workers. Under the National Alliance Programme, it distributes publications on on-farm technology testing, including validation and demonstration trials. At state level, each of the 32 states has an agricultural experimental station under the State Secretariat of the Agriculture Department. The State Secretariat Department of Agriculture’s Directorate of Rural Development has extension offices and farmers’ support centres in government zones, municipalities and villages. The Directorate of Rural Development employs subject-matter specialists and extension workers. The state-level research–extension linkage is promoted through meetings between researchers from

government experimental stations and the Directorate of Rural Development and through joint activities between the Directorate of Rural Development, state researchers and networks of farmers' foundations. The Mexican research-extension linkage system allows the decentralization of decision-making power to states and farmers' cooperatives. Farmers' foundations and non-governmental organisations take final decisions on the research needs/problems of the projects they finance or undertake jointly with government research stations. Since Research-extension linkages operate at state level, the status of extension agents is lowered. There is strong participation of farmers' cooperatives in decision-making (Agbamu, 2006).

#### **2.6.4 Nigeria**

All the agricultural, forestry and fisheries research institutes in Nigeria are owned by the central government; the states have no research institutes. Each of the 36 states is divided into extension districts. The extension workers and subject-matter specialists of the states Agricultural Development Programmes depend on the national research system for technologies. Nigeria is divided into five ecological regions. Five regional coordinating research institutes operating under the National Agricultural Research Project oversee the research needs and coordinate farming systems research activities in each ecological region. Research-extension linkages are promoted at regional level through regional research-extension committees and quarterly technology review meetings involving subject-matter specialists. In addition, the National Agricultural Extension and Research Liaison Service operates through the programmes of each national research institute and through regional offices. The Federal Agricultural Coordinating Unit works with collaborating institutions (research institutes, universities and Agricultural Development Programmes) in coordinating linkage activities. Although provision is made for farm input traders to participate in research-extension-farmer-input supply linkage system, their level of participation is weak. The identification of annual research needs is done through a joint problem diagnostic survey in each state by staff of national research institutes, universities and state Agricultural Development Programmes. There is lesser involvement of village extension officers in identifying farmers' needs for the formulation of research themes and plans. Although state Agricultural Development Programmes and national researchers participate in discussing the research problems at regional level, national officers assume power in finalising decisions on research themes, without farmers' representation. Most decisions on the direction of linkage

activities are taken at national level and research and extension organisations are unequal in status (Agbamu, 2006).

#### **2.6.5 South Korea (Republic of Korea)**

Agricultural research and extension in South Korea are incorporated within the Rural Development Administration, which is a structure of the Ministry of Agriculture and Forestry. It has authority over nine Provincial Rural Development Administrations, nine research institutes, four regional experiment stations, 32 location specific commodity experimental sites, 154 city/county extension offices and 1,380 farmers' consulting offices. To ensure the co-ordination of agricultural extension programmes between national and local levels, the funding of extension services comes from national, provincial and local governments. Research and extension are under one administration. Linkages are promoted through joint evaluation committees and on-farm adaptive experimental activities. Farmers' problems are identified through data collected by researchers, and final decisions are jointly taken by researchers, subject-matter specialists and other officers. The results of research are screened and subjected to economic analysis by research evaluation committees. Subject-matter specialists from the extension management bureau of Rural Development Administrations participate in research planning and evaluation activities. Similarly, researchers participate in extension programmes and have opportunities to review the applicability of their research findings. Both the research management agency and the extension management department have equal position inside the Rural Development Administrations and Provincial Rural Development Administrations. Research-extension linkages are administered at national level, and decisions from the top are passed down to lower management levels (Agbamu, 2006).

#### **2.6.6 Tanzania**

In Tanzania, research and extension are in different divisions in the Department of Agriculture and linkage mechanisms are not clearly spelt out. The three national research institutes fall under Research and Training and have substations in the 47 provinces. The Farming Systems Research-Extension Programme – also under the Division of Research and Training is managed by district directors and implemented at provincial level through Liaison Offices. Extension falls under the authority of the Department of Agriculture and Livestock Extension Services. Agriculture and Livestock development officers are stationed at regional

level, with agricultural extension officers and subject-matter specialists based in the provincial headquarters. District-level extension officers and village level farm advisers use the training and visit extension method. Research and subject matter specialists meet once a week and this symbolises a weak link between extension and subject matter specialists. Extension officials and subject-matter specialists informally inform researchers of farmers' problems. Furthermore, subject-matter specialists are as well informally involved in on-farm trials. Farmers participate in research–extension linkage programmes, particularly in rice production. There is unequal status between research and extension organisations, and the concentration of power at national headquarters. For Tanzania to enhance the linkage between research and extension, it will have to improve the quality of its extension staff through in- service training, undertake institutional revitalization to empower the provinces, increase funding for linkage activities and provide better means of transportation for district/village-level officers (Agbamu, 2006).

#### **2.6.7 Thailand**

The agricultural research system in Thailand is not yet integrated under a single authority at the national level. Under Thailand's Ministry of Agriculture and Cooperatives, there are departments of agriculture, agricultural extension, livestock, irrigation, forestry, fisheries, land development and others. Each of these departments has research institutes which are administered separately. The provincial governments have no independent research stations. The Department of Agricultural Extension is linked to regional extension offices, and these are connected to the provincial agricultural extension offices. There are also district and sub-district extension offices. The extension services aim to raise farmers' income and quality of life by focusing on the promotion of improved crop and livestock technology, crop protection and input/credit support. The subject-matter specialists are based in the provinces. Provincial extension offices formally receive research results by requesting research reports or when the Department of Agricultural Extension arranges seminars, conferences or group training; staff can also informally obtain results from the mass media on a personal interest basis. Only researchers identify farmers' needs and take decisions. Apart from meetings between researchers and subject-matter specialists held twice a year, there is no other evidence of routine linkage mechanisms between research and extension. There is no joint evaluation of on-farm trials, no farmers' participation, no joint decision-making and no staff exchanges (Agbamu, 2006).

### **2.6.8 Botswana**

In Botswana, researchers collaborated with communities to develop a sustainable learning environment that involves local and scientific knowledge. The process of learning combined public communication, consultation and participation. In each community, the researchers facilitated the learning process through bringing all different stakeholders together. The facilitation task involved guiding discussions and exploring the needs of participants. Facilitation took place in collaboration with district-level staff from the Department of Agriculture. The researcher were assisted by the national-level Department of Agriculture staff. This was important because it helped the researchers understand the processes, functions, constraints and opportunities within the farming system. Information flowed predominantly from stakeholders to researchers. However, only after all relevant stakeholders had been identified and their roles defined, could two-way information flows commence effectively between the stakeholder groups. This reflects a growing awareness that participatory processes take place in specific social–environmental and institutional contexts and that power relations set limits and social conditions on people’s participation in research–decision making and action (Reed, 2005).

The research stimulated a social-learning process that combined knowledge from local stakeholders with the scientific knowledge of researchers in order to provide a range of often innovative management options. By combining participatory research with insights from the scientific literature, more relevant results were provided than either scientific or local knowledge could have achieved alone. This matches outputs from a range of participatory agricultural development research on African farming systems which highlights the value of farmer knowledge and innovation, ultimately improving agricultural management practices (Mougeot, 2005). However, the participatory approach had problems: Particularly, the initial lack of collaboration with community members who did not own livestock, but who were identified at an early stage, whereby local extension staff facilitated the groups. Key individuals still attempted to dominate group sessions, so careful facilitation involving small groups, especially of poorer people and women, was essential to minimise social exclusion within the participatory research process. Despite these problems, the outcomes proved suitable enough to move to the second step of the project, where stakeholders were identified to monitor progress. This was achieved through a participatory process based on the facilitation of community-level focus groups. This stage was the most participatory, as

iterative and two-way exchanges of information and social learning occurred among researchers and stakeholders in the follow-up focus group discussions. Finally, sustainability indicators were linked to management strategies in locally appropriate manual- style decision-support systems. This is a clear indication that multi-stakeholder collaboration in the innovation system can produce more precise and locally relevant outcomes. Furthermore, multi-stakeholder collaboration can benefit all those involved as well as both local communities. Communication among all stakeholders is important and must be maintained all the time for the success of innovation (Stringer, Dougill and Frazer, 2006).

### **2.6.9 Lesotho**

Agriculture is a source of livelihood in Lesotho in that it has moved from a business enterprise to a social or community security. However, Turner (2004) notes that Basotho farm families have become increasingly passive in coping with their deteriorating resource base. The country has developed few market linkages between producers in rural areas and consumers in urban areas. Market institutional development has not been a priority with the government of Lesotho. There is lack of incentives to produce or to take product/ market risks. Where unfilled demand exists in specific local areas, prices fall to levels below the cost of production and local farmers are then unable to realise profit. Once markets defined by trading among neighbours or relatives are saturated, little opportunity exists to sell more to them and even less incentive exists to sell into more distant areas. As a consequence, prices quickly fell below the level of input costs. In addition to the institutional development of trading, venues where prices can be discovered and maintained and of market information systems which communicate prices from price discovery point more broadly to production areas, access to larger and more distant markets requires consistent quality and assured quantity control over production. Importantly, it also requires agents who are prepared to assume risk – to buy local products, transport and sell them in distant markets and indeed to contract for a specific quality and quality of supply. These commercial agents, who in their more sophisticated form, are referred to as supply chain integrators, are in extremely short supply in Lesotho. In fact, most agricultural production within Lesotho is consumed within households. Little intra or inter-village exchange actually takes place. Given these extremely narrow market parameters, incentives to produce more than is needed, specialise or to experiment with new products and new production methods are extremely limited. Over time the result has been a loss of dynamism within the agricultural sector (Turner, 2004).

### **2.6.10 Austria**

In Austria, the National Park was implemented in top-down and bottom-up approaches. One thousand five hundred (1500) people were involved in the negotiations to establish the park, each owning land. Semi-structured interviews were conducted with key stakeholders. The park was used for social and economic purposes, such as agriculture, tourism, hunting, fishing, reed-grass cutting and settlement. This made environmental protection more challenging. The ways in which the park was managed, highlights the challenges of managing different stakeholders and demonstrates the need for participatory processes to operate across a range of scales and institutional boundaries.

The establishment of the park was a challenge for participatory management, because it required the collaboration of national governments as well as different NGOs, community groups and landowners (multi-stakeholders). However, this project gained strong appeal across so many diverse sectors of society which shows how people can overcome political differences in order to solve common problems. Throughout the negotiations, information flowed initially from policy makers to other stakeholders. During the mid-stages of the process, however, community members were able to feed information back to policy-makers. People became involved in decision-making. However, there is little evidence that stakeholders were ever engaged in social learning in the early stages of the project. The way the process began was not particularly adaptive. In the course of the negotiations, various claims for use of the land had to be settled. However, broader, stakeholder participation, predominantly from the Austrian side, was becoming increasingly necessary, this made the process to become more iterative and adaptive.

Smaller-scale landowners were encouraged to form shared interest associations and choose representatives to participate in the negotiation processes. A negotiating team comprising of representatives of provincial authorities, the Austrian Ministry of the Environment, and environmental NGOs finalised the negotiations for the establishment of the park. A National Park planning institution acted as a mediator between the interests of landowners and private businesses, governmental institutions, and environmental NGOs. The government organised regular meetings with representatives of all relevant interest groups to facilitate learning and reach consensus-based decisions. Despite their top-down initiation, these meetings provided an opportunity for public participation, but also afforded the government a level of public

legality. Tourism enterprises, hunters and fishermen were organised in legal institutions that effectively acted as political pressure groups and provided the government with a legally authorized partner. Representatives were able to come together to discuss immediate problems and possible solutions relating to the implementation of the park. An agreement was reached through learning opportunity. At the government level, an institutional infrastructure was developed, comprising public servants from relevant departments and representatives from provincial and national levels. These stakeholders met to coordinate their plans toward the National Park, discuss legal affairs and financing, and make further decisions about the proceedings. These processes exemplify how participation is necessary among different institutional levels in order to achieve broader learning and understanding different viewpoints. To keep the local people informed about the Park, every household Austria receives a magazine. This is a way of communicating information to the public. Other tools for communication include a National Park Centre, information centers in each town and village in the area and a variety of printed documentary materials. Biodiversity issues and conservation were also introduced into the curricula of local schools and other educational institutions at all levels. Traditional top-down approaches were ineffective, supporting the need for practical and normative participation in social–ecological system management. Through communication and learning among different stakeholders, an agreement was reached to establish the park (Stringler, Dougill and Frazer, 2006).

## **2.7 Conceptual models of innovation system**

Innovation is everywhere in the world of technology, but is also discussed in the scientific and technical literature for an example, in social sciences like history, sociology, management and economics as well as in the humanities and arts. Innovation is also a central idea in the popular imaginary, in the media, in public policy and is part of everybody's vocabulary. However, it is an emblem of modern society, a panacea for resolving many problems and a phenomenon to be studied. Innovation is the process of making changes to something established by introducing something new that adds value to customers (Gordin, 2008). However, according to Hall, Mytelka and Oyeyinka (2005), innovation system is about the application of knowledge rather than research, it is the lifeblood of every organization. Without it, there will be no growth. However, effective innovation provides the solution to meeting growth demands. An innovation model signifies and implies shift in ideas

to generate the value needed to create sustained growth. The following are some models of innovation system:

### **2.7.1 Technology transfer model**

This has been used for spreading innovations. However extension organisations use the overall goals of technology transfer but the emphasis differs because in each extension organization, there are different objectives and even within countries, there is a mix of organisational patterns. In terms of agricultural development, this model assumes that farmers' problems can be solved by people and institutions that have new knowledge. Through this model, the researcher identified, analyzed and solved farmer's problems whereby solutions were developed at research stations. The results were then transferred through extension agents to farmers who acted as a link between farmers and researchers. Since researchers work independently from farmers and extension agents, this resulted in poor understanding of farmers' constraints and needs and consequently resulted in low adoption rates of technologies by farmers or the success of such technologies were not sustainable.

### **2.7.2 Advisory work**

Through this model, government organisations and / or non-governmental organisations respond to farmers' needs in terms of quality information and assistance. All important aspects of small-holder agriculture such as plant production, animal husbandry, home economics are attended to because the department established respective sections under its rule. Therefore, farmers are advised to use a specific practice or technology to solve the problem identified or production constraint. In this case, public extension organisations should have validated information from research about effectiveness of different inputs or methods in solving specific problems so that farmers receive the correct information. Most input supply organisations use persuasive advisory techniques when recommending specific technical inputs to farmers who want to solve a particular problem or maintain their productivity. Even though most organisations use persuasive methods to sell products to increase profit, an alternative private-sector model is to support out grower schemes where export organisations have field staff who advise and supervise farmers to ensure that specific production input and practices are followed.

### **2.7.3 Human resource development**

According to this model, universities provide training to all types of farm households in order to increase their technical and management skills. This model assumes that small-scale subsistence farmers and farm women generally lack basic education; therefore, their needs differ substantially from the skills needed by medium-scale, and, especially, commercial farmers. Also, the role of women within households differs considerably across different cultures, agro-ecological zones and farming systems. Therefore, this model differentiates among different types of farm households (small-scale/subsistence, medium-scale and larger/commercial farm households) and differences among men, women and rural young people within the household in order to give appropriate training.

### **2.8 Conclusion**

Chapter two has presented multi stakeholders involved in the agricultural innovation system to enhance extension service delivery. The context for comprehensive agricultural innovation system theory and principles has been expounded by the World Bank (2006). It has indicated how to adopt best practices to revitalise the performance of extension service delivery by using multi-sector approach, emphasizing the need for collaboration. This will, however, diminish the confusion of transferring knowledge and information to farmers by extension agencies because today's understanding of extension goes beyond technology transfer to facilitation and beyond training to learning.

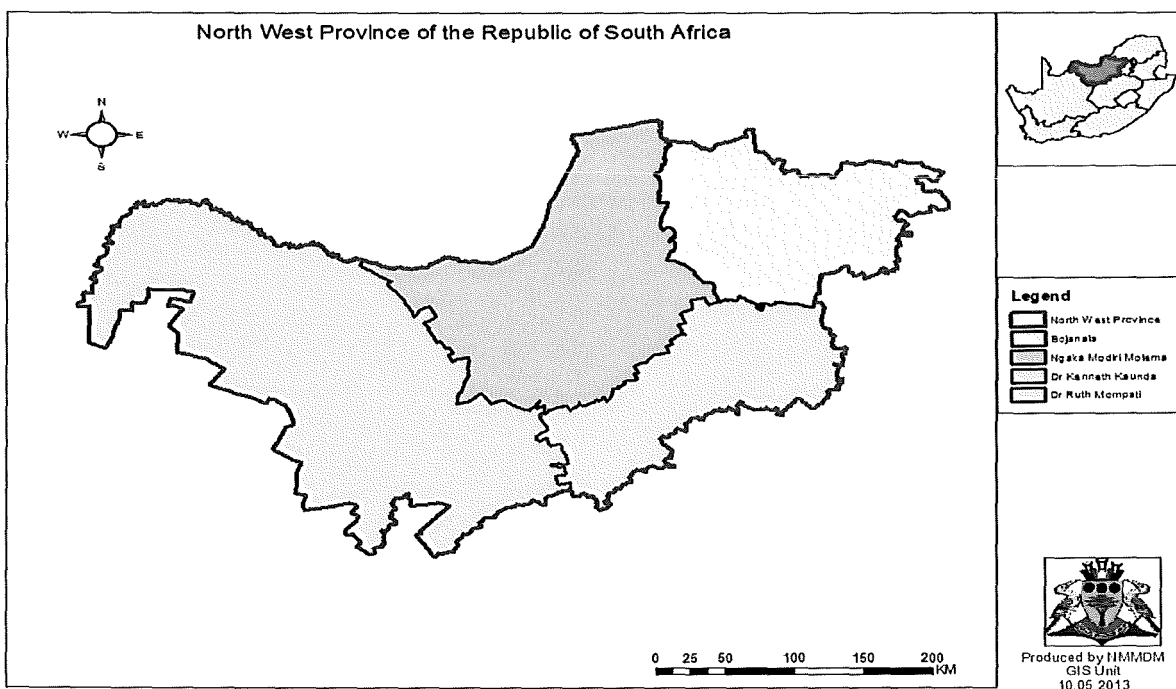
## CHAPTER THREE

### RESEARCH DESIGN AND METHODOLOGY

#### 3.1 Introduction

This chapter describes the methods used to collect data. The study is quantitative in nature. Primary data was collected from farmers, extension agents, researchers, input dealers and marketers of agricultural innovation system in the North West Province. The chapter also outlines the area where the research was conducted, the population of the study, the data collection techniques used and data analysis process.

#### 3.2 The study area



**Figure 1: Map of the North West Province**

The study was conducted in the North West Province of South Africa. It covered four districts, namely, Dr Segomotsi Mompati, Ngaka Modiri Molema, Dr Kenneth Kaunda and the Bojanala Platinum. The Province lies between 22 and 28 degrees longitude east of the Greenwich meridian, covering 116 320 km<sup>2</sup> or about 9,5% of South Africa's total surface area. The North West province share boundaries with the Northern Cape in the west, the Free State in the south, Gauteng in the east and Limpopo (formerly Northern Cape) in the east. The

Province is also characterised by great seasonal and daily variations in temperatures ranging from 17° to 31° Celsius in summer and 3° to 21° Celsius in winter. Annual rainfall totals about 360mm, falling during the summer months, between October and April. The North West has the largest cattle herds found in Stella near Vryburg. The areas around Brits and Rustenburg are fertile, providing mixed crop farming land. Maize and sunflowers are the most important crops and the North West is the major producer of white maize in the country.

### **3.3 Research design**

The research design is descriptive and quantitative. The study identified the demographic characteristics of stakeholders involved in the agricultural innovation system and examined linkage activities they are involved in. The study further identified constraints hindering collaboration among stakeholders, determined their attitudes to collaboration. Finally it examined whether stakeholders are aware and knowledgeable about agricultural innovation systems.

### **3.4 Population**

The population of the study consisted of stakeholders involved in the agricultural innovation system in the North West province from different organisations relevant to the study, such as researchers from the North West University and the Agricultural Research Council, extension officers from the Department of Agriculture and Rural Development, a group of farmers from the African Farmers Association of South Africa, the National African Farmers' Union and North West Emerging Red Meat Producer Organisation. Agricultural input dealers such as the North West Co-operative, marketers such as fruit and vegetables, pick 'n pay and Woolworths were also considered in the study.

### **3.5 Sampling procedure and sampling size**

A list of researchers, extension agents and farmers was obtained from their respective organizations within the North West province and the list served as a sampling frame for the study. For input dealers and marketers, there was no definite sampling frame. The frame for different groups was as follows: Extension agents from the Department of Agriculture and Rural Development (195), researchers from agricultural research and the North West University (135), registered farmers from African Farmers Association of South Africa, the

National African Farmers Union and the North West Emerging Red Meat Producer Organization (195). Simple random sampling technique was used to select respondents because each individual has the same probability of being chosen at any stage during the sampling process. The researcher decided to contact a maximum number of respondents but due to order situations in the province, a large sample size of  $n \geq 30$  was used to select the farmers, extension agents, researchers, marketers and input dealers for agricultural innovation system. A total of 205 respondents were randomly selected as follows: 60 extension agents, 50 researchers, 35 farmers, 30 input dealers and 30 marketers.

### **3.6 Data collection**

Data was generated from primary sources based on the objectives of the study. An interview schedule was used to elicit information from respondents. Data was collected through a structured questionnaire developed based on the study objectives and review of the relevant literature. Close-ended questions were used to collect demographic information such as gender, age, household size, religion, educational level and working experience in the first section.

The second section solicited information on linkage activities of respondents such as: Joint problem diagnosis, joint planning, joint training, setting priorities and share use of resources. This was measured in a three point scale indicating: Regular (3), occasionally (2) and never (1). The third section focused on the constraints hindering collaboration among respondents, and was measured in a two point scale of Yes (2) and No (1). The fourth section had items on the attitudes of respondents to collaboration such as colleagues come with their own bias, colleagues have different ideas, not all stakeholders have the ability to collaborate, there is duplication of efforts in collaboration. These items were measured in a Likert scale of 5: Strongly agree (5), Agree (4), Undecided (3), Disagree (2), and Strongly disagree (1) The fifth section provided a knowledge test to agricultural innovation system administered to respondents. The knowledge test included the following items: Agricultural prosperity depends on new innovations; Innovation is the application of knowledge and skills from different sources; Innovation system plays an important role in developing human and social capital; Agricultural innovation system plays a role in job creation. This knowledge test was measured in a two point scale of True (2), False (1).

### 3.7 Data analysis

Data collected was sorted, coded and analyzed using the Statistical Product and Service Solution (SPSS). The data collected was analyzed using both descriptive statistics such as mean, percentage and frequency distribution. Analysis of variance and multiple regression analysis were equally used to measure the personal characteristics, attitude, extent of collaboration, linkage activities, and constraints hindering collaboration among farmers, extension agents, researchers, input dealers and marketers. The purpose of using multiple regression is to understand the functional relationships between the dependent and independent variables and to see what might be causing the variation in the dependent variable. The model explains how a dependent variable (y) is related to more than one independent variables, for an example, (X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub>). The model used is implicitly stated as:

$$y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5$$

y = existing collaboration among farmers, extension agents, researchers, input dealers and marketers. Where,

b's – regression co-efficiencies

X<sub>1</sub> – Personal characteristics of farmers, extension agents, researchers, input dealers and marketers, including gender, age, marital status, household size and religion.

X<sub>2</sub> – Attitude of farmers, extension agents, researchers, input dealers and marketers towards collaboration.

X<sub>3</sub> - Farmers, extension agents, researchers, input dealers and marketers' knowledge of AIS.

X<sub>4</sub> - Linkage activities among farmers, extension agents, researchers, input dealers and marketers' knowledge of AIS.

X<sub>5</sub> – Constraints hindering farmers, extension agents, researchers, input dealers and marketers to collaboration

### 3.8 Ethical considerations

Given that this study required the participation of human respondents, ethical issues had to be addressed. The considerations of these ethical issues are necessary for the purpose of ensuring the privacy as well as the safety of participants. Some of the significant ethical issues considered in the research process included consent and confidentiality. In order to

secure the consent of selected respondents, the researcher explained all important details of the study, including its aim and purpose to participants. By explaining these important details, respondents were able to understand the importance of their role in the completion of the research questionnaire. Respondents were also informed that they had the right to withdraw or not to participate in the study. The confidentiality of respondents was also ensured by not disclosing their names or personal information in the research questionnaire. Only relevant details to assist in answering the research questions were included in the questionnaire.

### **3.9 Conclusion**

This chapter has presented an overview of how the study was conducted. Data was collected from farmers, extension agents, researchers, input dealers and marketers of agricultural innovation system in the North West province. Primary data is important because it allows researchers to get original ideas that will assist in developing the appropriate model for agricultural innovation system. A questionnaire was designed as a tool for data collection. Collected data was coded and entered into Microsoft Excel and later transferred to SPSS.

## CHAPTER 4

### RESULTS AND DISCUSSION

#### 4.1 Introduction

This chapter presents the results of the study. The chapter covers information on demographic characteristics, linkage activities, constraints to collaboration, attitudes of respondents towards collaboration and their knowledge of agricultural innovation system as well as the one way analysis of variance showing differences among stakeholders.

#### 4.2 Demographic characteristics of respondents

Table 1 indicates that extension agents were predominantly males (65%) and only 35% were females. This might be attributed to socio-cultural factors which favour men. Oladele (2011) maintains that it is a wide belief that males are dominating the agricultural sector compared to females. Martey, Etwire, Wiredu and Dogbe (2014) point out that that females usually lack access to agricultural resources that enhance their participation in social activities and innovation.

Table 1 also presents the age of respondents, about 50% (extension agents), 46% (farmers) and 60% (marketers) are over fifty years respectively. Input dealers (40%) fall within the range of 41- 49 years. This implies that they are in the productive stage and this would help increase food production. However, researchers (56%) were found to be are less than 40 years of age.

Furthermore table 1 presents the marital status of the respondents. It was found that researchers (64%) farmers (71%) were married, Nnadi and Akwiwu (2008) found that marriage increases a farmer's concern for household welfare and food security which is therefore likely to have a positive effect on their decision to participate in an agricultural project. The table also shows that input dealers (70%) and marketers (90%) were married. 65% of extension agents were single.

Household size is also presented in Table 1. About 52% of extension agents, 58% researchers, 58% farmers, 73% input dealers and 74% marketers revealed that their



household size falls within the bracket of 3 to 5 persons. This might be because of the fact that the cost of living has become too high and people prefer to have fewer family members. This is contrary to the findings of Wiredu, Martey and Etwire (2013) who found that household size serves as a form of family labour and complements the efforts of household heads on the farm.

Table 1 further presents the educational level of respondents. 40% of the extension agents have a degree or qualification, 52% of researchers have a master's degree, 40% of farmers have certificates, 53% of input dealers have a diploma and 90% of marketers have certificates. This shows that respondents can make decisions. Enete and Igbokwe (2009) found that education enables people to make independent choices and act on the basis of the decision. It further increases the tendency to collaborate with others and participate in group activities.

Table 1 further reveals the distribution for studying for a higher qualification. A high percentage of respondents were found not to be studying for a higher qualification. 52% of extension agents and 58% of researchers and this might be as a result of the higher qualifications they already have. However, some of them indicated that their workload makes it difficult for them to pursue their studies. Farmers 83% indicated that it is difficult for them to further studies because in addition to farm the work, they also have family responsibilities. Input dealers represented (70%) and marketers (97%)

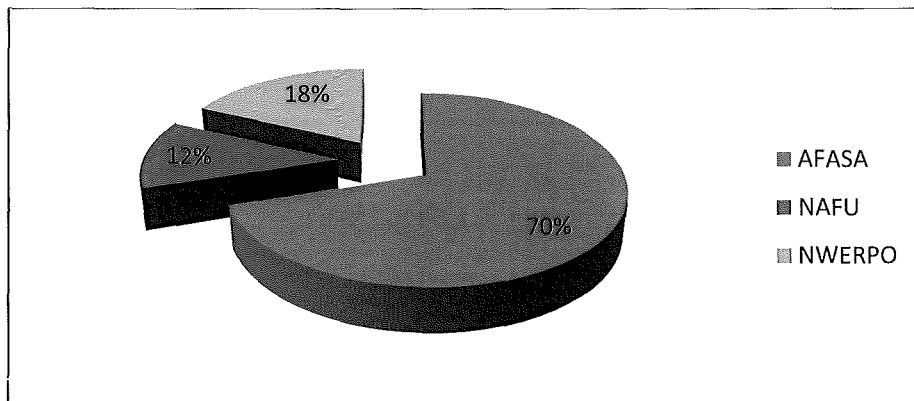
The findings in Table 1 depict that 37% of extension agents have more than 20 years of working experience compared to 38% of researchers, and 46% of farmers. This is contrary to Adesoji, Farinde and Ajayi (2006) who found that only 22% of farmers have more than ten years of farming experience. Furthermore, 44% of input dealers were found to have working experience of 6 to 10 years. However, long work experience is helpful because it enables one to understand what working environments are like and to adhere to the conditions, and demonstrate to the best of his/her ability.

**Table 1 Demographic characteristics of respondents**

VARIABLES	EXTENSION		RESEARCHERS		FARMERS		INPUT DEALERS		MARKETERS	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
<b>Gender</b>										
Male	39	65	34	68	18	51	22	73	21	70
Female	21	35	16	32	17	49	8	27	9	30
<b>Age</b>										
< 40 Years	16	27	28	56	12	34	10	33	4	13
41-49 Years	14	23	13	26	7	20	12	40	8	27
>50 years	30	50	9	18	16	46	8	27	18	60
<b>Marital status</b>										
Single	51	85	15	30	7	20	7	23	1	3
Married	2	3	32	64	25	71	21	70	27	90
Divorced	7	12	3	6	0	0	1	3	1	3
Widowed	0	0	0	0	3	9	1	3	1	3
<b>Household size</b>										
1 -2 members	11	18	14	28	0	0	1	3	4	13
3 - 5 members	31	52	29	58	20	58	22	73	22	74
> 5 members	18	30	7	14	15	43	7	23	4	13
<b>Highest Educ. Level</b>										
No formal education	0	0	0	0	11	31	0	0	0	0
Certificate	12	20	0	0	14	40	6	20	27	90
Diploma	18	30	0	0	8	23	16	53	3	10
Degree	24	40	3	6	1	3	7	23	0	0
Honours	5	8	5	10	1	3	1	3	0	0
Masters	1	2	26	52	0	0	0	0	0	0
PhD	0	0	16	32	0	0	0	0	0	0
Yes	29	48	21	42	5	17	9	30	1	3
No	31	52	29	58	30	83	21	70	29	97
<b>Working experience</b>										
1 -5 years	5	8	12	20	6	17	4	13	-	-
6-10 years	15	25	19	38	16	46	13	44	-	-
11-15 years	14	23	8	16	3	9	7	23	-	-
16-20 years	4	7	3	6	4	11	3	10	-	-
> 20 years	22	37	8	16	6	17	3	10	-	-

### 4.3 Membership of farmer organisations

The results in Figure 1 show that majority (70%) of farmers are affiliates of the African Farmers Association of South Africa (AFASA) and (18%) are members of the North West Emerging Red Producer Organisation (NWERPO). The minority (12%) are affiliates of the National African Farmers Union. Figure1 proves that farmers now have a new and powerful voice. The willingness of the farmers to become a member shows that they want to act in unity, to make decisions together.



**Figure 2: Farmer organisations**

### 4.4: Linkage activities

The term linkage as used in this study, encompasses a wide range of collaborations and exchange of information among all stakeholders of the innovation system. In a multi - institutional environment, it would be efficient for various stakeholders to elucidate their roles based on both their strengths and weaknesses. Thus, linkage among agricultural stakeholders is crucial as it enhances production.

#### 4.4.1 Linkage activities of extension agents

Agricultural extension is a policy instrument which governments can use to stimulate Agricultural development (Oladele, 2011). Therefore, each country needs to have an agricultural policy that coordinates all actors in the innovation system, including researchers, input dealers and marketers of the agricultural sector to be more dynamic.

Table 2 presents the percentage of involvement of extension agents, farmers, researchers, input dealers and marketers for collaboration in the North West Province. Out of 27 linkage activities identified, most extension agents indicated their involvement on: Joint feedback (98%), extension service (98%), evaluation of trials (98%), joint demonstration (98%), field days (98%), setting priorities (97%), financial resources (97%), joint problem diagnosis (95%), joint research activities (94%), joint training (88%) and joint workshop for extension personnel (87%). This may be due to the fact that these are practical activities in which extension agents are evaluated.

However, prominent activities among extension agents with farmers are knowledge generation (92%), joint implementation (90%), management capacity (88%), joint evaluation of trials and problem delineation (80%). This may be attributed to the fact that for all these activities, farmers' inputs are important in that extension cannot work in isolation. According to Ofuoku (2013), extension agents and farmers' communication factors include human relations, communication skills and role performance. However, according to Agbamu (2006), these factors could enhance or weaken the success of a development programme.

Aker (2011) notes that research should be part of the information chain. The results in Table 2, reveal that out of twenty two linkage activities identified, extension agents and researchers are involved in problem diagnosis (38%) and evaluation reports (35%). This result signifies a weak linkage between extension agents and researchers. This gives a clear indication that research and extension disseminate information to farmers without first discussing the needs of farmers. However, Adugna (2013) notes that linkages are facilitated when research institutions and extension agents recognise the worthiness of shared information and encourage unified strategies to problem solving in order to avoid duplication of efforts. Oladele (2010) argues that prominent activities identified for researchers are joint problem identification and evaluation meetings.

Agricultural inputs help increase agricultural production and are crucial in the production cycle. However, out of twenty seven linkage activities identified, extension agents and input dealers indicated their involvement in joint planning (13%), training (13%), setting priorities (13%), knowledge generation (13%), joint implementation (13%), joint monitoring (13%),

feedback (13%), joint extension service (13%) and evaluation trials (13%). This signifies a low involvement. Ogulande (2012) also found that the link between input dealers and agricultural related institutions is weak. This weak linkage might be because input suppliers are mostly located in towns. On the other hand, marketers indicated that their involvement was for problem diagnosis (8%). Out of the 27 activities identified as very low, the linkage on other 26 activities was very low.

**Table 2: Linkage activities of extension agents**

Function	Y	N	Frequency with farmers			Frequency with researchers			Frequency with input dealers			Frequency with marketers		
			R	O	N	R	O	N	R	O	N	R	O	N
Problem diagnosis	57(95)	2(3)	39(65)	11(18)	10(16)	22(38)	36(60)	2(3)	3(5)	49(82)	8(13)	5(8)	10(17)	45(75)
Planning	60	60	46(77)	9(15)	5(8)	10(17)	45(75)	5(8)	3(13)	39(65)	18(30)	2(3)	15(25)	43(72)
Training	53(88)	7(12)	26(43)	23(38)	11(18)	7(12)	53(88)	0	3(13)	49(82)	8(13)	2(3)	7(12)	51(85)
Setting priorities	58(97)	2(3)	26(43)	23(38)	11(18)	5(8)	42(70)	13(22)	3(13)	35(58)	22(37)	2(3)	8(18)	50(83)
Share use of resources	58(96)	2(4)	50(83)	9(15)	1(2)	0	23(38)	37(62)	6(10)	29(48)	25(42)	2(3)	8(18)	50(83)
Knowledge generation	60	60	55(91.7)	4(6.7)	1(1.7)	2(3.3)	54(90.0)	4(6.7)	3(13)	43(72)	14(23)	2(3)	11(18)	47(78)
Joint implementation	60	60	54(90)	4(7)	2(3)	0	23(38)	37(62)	3(13)	26(43)	31(52)	2(3)	1(1.7)	57(95)
Joint monitoring	60	60	46(77)	10(17)	4(7)	4(7)	16(27)	40(67)	3(13)	25(42)	32(53)	1(2)	0	59(98)
Joint feedback	59(98)	1(2)	46(77)	10(17)	4(7)	7(12)	40(67)	13(22)	3(13)	23(38)	34(57)	1(2)	11(18)	48(80)
Joint extension service	59(98)	1(2)	19(32)	23(38)	18(30)	5(8.3)	55(92)	0	3(13)	42(70)	15(25)	1(2)	9(15)	50(83)
Joint use of sms for service providers	23(38)	37(22)	22(37)	11(18)	27(45)	3(5)	47(78)	10(17)	3(13)	36(60)	21(35)	1(2)	11(18)	48(80)
Joint evaluation	59(98)	1(2)	48(80)	7(12)	5(5)	6(10)	43(72)	11(18)	3(13)	37(62)	20(33)	1(2)	0	59(98)
Joint survey	59(98)	1(2)	45(75)	10(17)	5(8)	6(10)	47(78)	7(12)	3(13)	22(37)	35(58)	1(2)	2(3)	57(95)
Joint workshop for extension personnel	52(87)	8(13)	19(32)	19(32)	22(37)	3(5)	55(92)	2(3)	3(13)	43(72)	14(23)	1(2)	12(20)	47(78)
Joint research activities	56(94)	4(6)	35(58)	16(27)	9(15)	11(18)	49(82)	0	6(10)	30(50)	24(40)	1(2)	7(12)	52(87)
Joint field visits	60	60	35(58)	16(27)	9(15)	6(10)	39(65)	15(25)	4(5)	25(42)	31(52)	0	7(12)	53(88)
Knowledge dissemination	60	60	52(87)	5(8)	3(5)	3(5)	46(77)	11(18)	0	48(80)	12(20)	0	12(20)	48(80)
Joint seminar and workshop	60	60	27(45)	22(37)	11(18)	7(12)	50(83)	3(5)	6(10)	35(58)	19(32)	0	11(18)	49(82)
Joint demonstration	59(98)	1(2)	45(75)	6(10)	9(15)	9(15)	34(57)	17(28)	2(3)	38(63)	20(33)	0	9(15)	51(85)
Evaluation reports	49(82)	11(18)	40(67)	17(28)	3(5)	21(35)	25(42)	14(23)	3(13)	22(37)	35(58)	0	4(7)	56(93)

Management capacity	51(85)	9(15)	53(88)	5(8)	2(3)	7(12)	8(13)	45(75)	2(3)	6(10)	52(87)	0	4(7)	56(93)
Report publication	49(82)	11(18)	41(68)	15(25)	4(7)	1(2)	28(47)	31(52)	2(3)	10(17)	48(80)	0	7(12)	53(88)
Reward system	32(52.3)	28(47) 6	27(45)	20(33)	13(22)	1(2)	19(32)	40(67)	2(3)	8(13)	50(83)	0	4(6.7)	56(93)
Research contracts	49(81.7)	11(18)	19(32)	19(32)	22(37)	5(8)	40(67)	15(25)	2(3)	19(32)	39(65)	0	3(5.0)	57(96)
Problem delineation	58(97)	2(3)	48(80)	11(18)	1(2)	11(18)	46(77)	3(5)	3(13)	38(63)	19(32)	0	5(8)	55(92)
Field days	59(98)	1(2)	46(77)	12(20)	2(3)	5(8)	44(73)	11(19)	3(13)	38(63)	19(32)	1(2)	14(23)	45
Financial resources	58(97)	2(3)	23(38)	24(40)	13(22)	7(12)	13(22)	40(67)	4(7)	23(38)	33(55)	1(2)	15	44(75)

**\* R – Regularly, O – Occasionally, N – Never \* Figures in parenthesis are percentages**

#### 4.4.2 Linkage activities of farmers

Farmer participation is a relevant ingredient for technology development. Table 3 presents the linkage activities of farmers with extension agents, researchers, input dealers and marketers. Majority of farmers indicated that they are involved in joint seminars / workshops (98%) and Joint demonstration (98%). This was followed by joint problem diagnosis (97%). These may be due to the fact that problems identified might assist in developing appropriate strategy. Farmers further agreed that they were involved in planning (97%), training (97%), setting priorities (97%), knowledge generation (97%), joint implementation (97%), evaluation trials (97%), joint research activities (97%), field visit (97%), research contracts (97%), field days (97%), financial resources (97%), joint seminar and workshop (89%), management capacity (89%), report publication (86%), joint feedback (83%) and joint survey (83%). All these might be attributed to the fact that farmers' contribution is needed. Thus the complementary support of farmers cannot be ignored. However, Oladele (2010), maintains that farmers are highly involved in establishment of small plot adoption technology, dissemination of knowledge, joint demonstration of trials and joint field visit.

But when farmers were asked about their frequencies with researchers, it was found that out of twenty seven linkage activities identified, farmers and researcher do planning together (11%), training (9%), monitoring (3%), joint workshop and seminar (4%), demonstration (6%), evaluation reports (9%), management capacity (11%), report publication (16%) and research contract (6%). This shows a weak linkage between farmers and researchers. The results indicate a weak linkage between farmers and researchers. However, Merrill-Sands and Collion (2014) found that farmers are rarely powerful or well organised enough to bring pressure to bear on researchers in order to respond to their needs and priorities. De Rosario (2010) points out that farmers are usually invited in the experimental stages but few collaborate. However, it is necessary for better efficiency that the representation of farmers in agricultural research at local, national, regional and international levels be institutionalised. Formalising this representation would contribute to long-term collaboration between farmers and researchers for the good of both sides.

Table 3 depicts linkage activities carried out by farmers with input dealers. Out of twenty seven listed items for respondents, farmers and input dealers are regularly involved in nine

items as follows: joint planning (3%), setting priorities (3%) and evaluation reports (4%). This signifies a weak linkage and might be attributed to lack of knowledge by farmers on how to use inputs. Inputs might be in the form of improved seeds, fertilizers, machineries, and implements as important requirements for high production. Ferroni (2012) found that farmers need to frequently receive advice from input dealers because they provide products as well as knowledge on how to utilise such products.

Furthermore Table 3 shows the activities carried out by farmers and marketers. They were regularly involved in joint training (3%), setting priorities (6%) and share use of resources (3%). It is obvious from this study that farmers' linkage with and input dealers is weak.

**Table 3: Linkage activities of farmers**

Function	Y	N	Frequency with extension officers			Frequency with researchers			Frequency with input dealers			Frequency with marketers		
			R	O	N	R	O	N	R	O	N	R	O	N
Problem diagnosis	34(97)	1(3)	28(80)	7(20)	0	1(3)	34(97)	0	0	33(94)	2(6)	0	20(57)	15(43)
Planning	34(97)	1(3)	32(94)	3(9)	0	4(11)	30(86)	1(3)	1(3)	30(86)	4(11)	0	18(52)	17(47)
Training	34(97)	1(3)	23(66)	12(34)	0	3(9)	29	3(9)	0	29(83)	6(17)	1(3)	15(43)	19(54)
Setting priorities	34(97)	1(3)	32(91)	3(9)	0	0	28(8)	7(20)	1(3)	24(69)	10(29)	2(6)	18(51)	15(43)
Share use of resources	24(67)	11(31)	21(60)	8(23)	6(17)	0	8(23)	27(77)	0	25(71)	10(29)	1(3)	24(69)	10(29)
Knowledge generation	34(97)	1(3)	25(71)	8(23)	2(6)	0	16(46)	19(54)	0	22(63)	13(37)	0	16(46)	19(54)
Joint implementation	34(97)	1(3)	31(88)	4(11)	0	0	16(46)	19(54)	0	14(40)	21(60)	1(3)	8(23)	26(74)
Joint monitoring	31(89)	4(11)	16(46)	19(54)	0	1(3)	17(49)	17(49)	0	16(46)	19(54)	1(3)	11(31)	23(66)
Joint feedback	29(83)	6(17)	26(74)	9(26)	0	0	34(97)	1(3)	0	23(66)	12(34)	1(3)	15(43)	19(54)
Joint extension service	23(64)	12(34)	7(20)	24(69)	4(11)	0	15(43)	20(57)	0	9(26)	26(74)	1(3)	11(31)	23(66)
Joint use of sms for service providers	9(26)	26(74)	9(26)	10(29)	16(46)	0	9(26)	26(74)	0	9(26)	26(74)	1(3)	13(37)	21(60)
Joint evaluation of trials	34(97)	1(3)	21(60)	12(32)	2(6)	0	16(46)	19(54)	1(3)	9(26)	25(71)	0	8(23)	27(77)
Joint survey	29(83)	6(17)	26(74)	8(23)	1(3)	0	25(71)	10(29)	1(3)	19(54)	15(43)	1(3)	17(49)	17(49)
Joint workshop for extension personnel	22(63)	13(37)	13(37)	11(31)	11(31)	0	23(66)	12(34)	0	16(46)	19(54)	1(3)	19(54)	15(43)
Joint research activities	34(97)	1(3)	28(80)	6(17)	1(3)	1(3)	34(97)	0	0	22(70)	13(37)	1(3)	19	15(43)
Joint field visits	34(97)	1(3)	31(89)	4(11)	0	1(3)	27(78)	7(20)	0	18(51)	17(49)	0	25(71)	10(29)
Knowledge dissemination	28(80)	7(20)	26(74)	8(23)	1(3)	1(3)	21(60)	13(37)	0	22(63)	13(37)	0	22(63)	13(37)
Joint seminars and workshops	34(98)	1(3)	14(40)	21(60)	0	3(4)	19(54)	13(37)	0	30(86)	5(14)	1(3)	24(69)	10(29)
Joint demonstration	34(98)	1(3)	15(43)	20(57)	0	2(5.7)	14(40)	19(54)	1(3)	29(83)	5(14)	0	10(29)	25(71)
Evaluation reports	23(66)	12(34)	21(60)	8(23)	6(17)	3(8.6)	10(29)	22(63)	4(11)	17(49)	14(40)	0	11(31)	24(68.6)

									)					
Management capacity	31(89)	4(11)	26(74)	9(25)	0	4(11)	6(17)	25(71)	1(3)	15(43)	19(54)	2(2)	10(29)	23(66)
Report publication	30(86)	5(14)	22(63)	12(34)	1(3)	5(14)	29(83)	1(3)	2(6)	12(34)	21(60)	1(3)	12(34)	22(63)
Reward system	22(63)	13(37)	6(18)	24(69)	5(14)	0	12(34)	23(66)	0	14(40)	21(60)	0	15(42.9)	20(57)
Research contracts	34(97)	1(3)	25(71)	9(26)	1(3)	2(6)	23(66)	10(28.6)	0	24(69)	11(31)	1(2.9)	15(43)	19(54)
Problem delineation	32(91)	3(8.6)	25(71)	9(26)	1(3)	0	29(83)	6(17)	0	25(71)	10(29)	1(2.9)	16(48)	18(51)
Field days	34(97)	1(3)	25(71)	9(26)	1(3)	0	22(63)	13(37)	1(2.9)	26(74)	8(22.9)	2(5.7)	16(46)	17(49)
Financial resources	34(97)	1(3)	13(37)	8(23)	14(40)	0	16(48)	19(54)	0	29(83)	6(17)	1(3)	30(86)	4(11)

\* R – Regularly, O – Occasionally, N – Never / \* Figures in parenthesis are percentages

#### 4.4.3 Linkage activities of researchers

Table 4 shows the results of linkage activities of researchers with extension agents, farmers, input dealers and marketers. Out of twenty seven linkage activities identified, researchers indicated as follows: Knowledge generation (84%), joint seminar (72%), joint field visit (68%), problem diagnosis and field days (66%). These involvements may be due to the fact that researchers need to develop relevant technologies.

Researchers and extension agents were regularly involved in joint planning and training (32%) and knowledge dissemination (32%). This signifies a weak link between researchers and extension agents. However, agricultural research and extension need to be strongly linked with information flow and feedback because they are both involved in technology development and transfer. Wongsodikromo (2012) found that weak link between research and extension inhibits extension work. According to Qamar (2005), weak linkage among researchers and extension agents is attributed to the fact that research focuses on technical aspects in order to generate technologies which they think farmers will automatically adopt, while extension focuses on the adoption of those technologies by end users. It is important that researchers communicate regularly with extension agents about the appropriateness of innovations. Qamar (2005) suggests that research and extension can be under one administration in order to allow for regular, effective and efficient communication. However, Oladele (2013) argues that research stops too early and extension starts too late in what should be a continuous process.

Meeting of researchers and farmers creates a platform for farmers to report the performance of technologies released by research and researchers are also able to understand farmers' priorities. The results in Table 4 reveal that farmers were occasionally involved with researchers as follows: Problem diagnosis (58%) and dissemination of knowledge (56%). These results might have been better if farmers were involved in the planning process, which was never done (50%). The Planning Commission (2008) found that generally, links between research and farmers is inadequate.

Table 4 also shows that researchers occasionally collaborate with input dealers for knowledge generation (62%). Ladele (2012) found that irregular accessibility of information is a

Table 4: Linkage activities of researchers

Function	Y	N	Frequency with extension agents			Frequency with farmers			Frequency with input dealers			Frequency with marketers		
			R	O	N	R	O	N	R	O	N	R	O	N
Problem diagnosis	33(66)	17(34)	7(14)	28(56)	15(30)	10(20)	29(58)	11(22)	3(6)	23(46)	24(48)	7(14)	18(36)	25(50)
Planning	26(52)	24(48)	16(32)	14(29)	20(40)	7(14)	18(36)	25(50)	3(6)	14(28)	33(66)	6(12)	15(30)	29(58)
Training	30(60)	20(40)	16(32)	17(34)	17(34)	9(18)	16(32)	25(50)	5(10)	15(30)	30(60)	7(14)	17(34)	26(52)
Setting priorities	22(44)	28(56)	17(17)	12(24)	21(42)	10(20)	12(24)	28(56)	4(8)	16(32)	30(60)	5(10)	15(30)	30(60)
Share use of resources	25(50)	25(50)	5(10)	23(46)	11(22)	8(16)	16(32)	26(52)	1(2)	21(42)	28(56)	4(8)	18(36)	28(56)
Knowledge generation	42(84)	8(16)	11(22)	23(46)	16(32)	13(26)	24(48)	13(26)	0	31(62)	19(39)	3(6)	22(44)	25(50)
Joint implementation	23(46)	27(54)	13(26)	8(16)	29(58)	3(6)	20(40)	27(54)	1(2)	15(30)	34(68)	2(4)	17(34)	31(62)
Joint monitoring	23(46)	27(54)	8(16)	11(22)	31(62)	6(12)	12(24)	32(64)	0	8(18)	42(84)	1(2)	17(34)	32(64)
Joint feedback	26(52)	24(48)	8(16)	17(34)	25(50)	9(18)	15(30)	26(53)	1(2)	6(12)	43(46)	2(4)	15(30)	33(66)
Joint extension service	27(54)	23(46)	8(16)	22(44)	20(40)	14(28)	13(26)	23(46)	1(2)	8(16)	41(82)	2(4)	17(34)	31(62)
Joint use of sms for service providers	26(52)	24(48)	9(18)	18(36)	23(46)	4(8)	14(28)	32(64)	2(4)	5(10)	43(86)	3(6)	15(30)	32(64)
Joint evaluation of trials	26(52)	24(48)	9(18)	14(28)	27(54)	9(18)	10(20)	31(62)	1(2)	6(12)	43(86)	2(4)	11(22)	37(74)
Joint survey	22(44)	28(56)	9(18)	15(30)	26(52)	11(22)	17(34)	22(44)	0	9(18)	41(82)	1(2)	14(28)	35(70)
Joint workshop for extension personnel	31(62)	19(38)	10(20)	24(48)	16(32)	9(18)	22(44)	19(38)	4(8)	7(14)	39(78)	1(2)	11(22)	38(76)
Joint research activities	31(62)	19(38)	10(20)	21(42)	19(38)	11(22)	20(40)	19(38)	5(10)	5(10)	40(80)	3(6)	7(14)	40(80)
Joint field visits	34(68)	16(32)	10(20)	21(42)	19(38)	9(18)	25(50)	16(32)	2(4)	4(8)	44(88)	3(6)	6(12)	41(82)
Dissemination of knowledge	43(86)	7(14)	16(32)	20(40)	14(28)	14(28)	28(56)	8(16)	1(2)	15(30)	34(68)	3(6)	8(16)	39(78)
Joint seminars and workshops	36(72)	14(28)	10(20)	20(40)	20(40)	10(20)	24(48)	16(32)	3(6)	11(22)	36(72)	4(8)	11(22)	35(70)
Joint demonstration	23(46)	27(54)	6(12)	18(36)	26(52)	7(14)	20(40)	23(46)	8(16)	8(16)	34(68)	5(10)	9(18)	36(72)

Evaluation reports	18(36)	32(64)	5(10)	18(36)	28(36)	6(12)	19(38)	25(50)	11(22)	4(8)	35(70)	7(14)	9(18)	34(68)
Management capacity	15(30)	35(70)	3(6)	18(36)	29(58)	7(14)	14(28)	29(58)	11(22)	5(10)	34(64)	6(12)	9(18)	35(70)
Report publication	18(38)	32(64)	2(4)	23(46)	25(50)	10(20)	9(18)	31(62)	10(20)	7(14)	33(66)	8(16)	7(14)	35(70)
Reward system	11(22)	39(78)	1(2)	20(40)	29(58)	10(20)	13(26)	27(54)	10(20)	6(12)	34(68)	7(14)	7(14)	36(72)
Research contracts	19(38)	31(62)	4(8)	19(38)	27(54)	13(26)	15(30)	22(44)	10(20)	8(16)	32(64)	7(17)	9(18)	34(68)
Problem delineation	26(52)	24(48)	4(8)	27(54)	19(38)	15(30)	16(32)	19(38)	10(20)	13(26)	27(27)	5(10)	9(18)	36(72)
Joint field days	33(66)	17(34)	9(18)	26(52)	15(30)	10(20)	22(44)	18(36)	10(20)	1(2)	29(58)	5(10)	9(18)	36(72)
Financial resources	31(62)	19(39)	5(10)	21(42)	24(48)	8(16)	17(34)	25(50)	11(22)	15(30)	24(48)	5(10)	8(16)	37(74)

\* R – Regularly, O – Occasionally, N – Never\* Figures in parenthesis are percentage

#### **4.4.4 Linkage activities of marketers**

Table 5 presents the linkage activities for collaboration of marketers with farmers, researchers, input dealers and extension agents. Most of the marketers agreed on joint workshop for extension personnel (83%) and knowledge generation (67%). Marketers indicated their irregular involvement with farmers in joint training and planning (87%), problem diagnosis (83%), evaluation reports, management capacity, report publication (73%), setting priorities, share use of resources and knowledge generation and dissemination of knowledge (70%).

Table 5 shows that marketers and researchers were involved in the following activities: Problem diagnosis (67%), joint planning (63%), joint training and management capacity (60%). Marketers and input dealers were also involved in planning (80%), problem diagnosis (77%), setting priorities and joint evaluation of trials (73%). In terms of collaboration with input dealers, marketers indicated that they were involved in joint planning (80%), problem diagnosis (77%), setting priorities, joint evaluation of trials (73%), and share use of resources (67%). Table 5 shows that marketers were occasionally involved with extension agents in management capacity (85%), joint planning (80%), setting priorities (80%), reward system (76%), evaluation reports (73%), joint survey (73%) and joint evaluation of trials (73%).

**Table 5: Linkage activities of marketers**

Function	Y	N	Frequency with farmers			Frequency with researchers			Frequency with input dealers			Frequency with extension agents		
			R	O	N	R	O	N	R	O	N	R	O	N
Problem diagnosis	4(13)	26(87)	2(7)	25(83)	3(10)	0	20(67)	10(33)	3(10)	23(77)	4(13)	0	23(77)	7(23)
Joint planning	5(17)	25(83)	1(3)	26(87)	3(10)	0	19(63)	11(37)	1(3.3)	24(80)	5(16.7)	0	24(80)	6(20)
Joint training	10(33)	20(67)	2(7)	26(87)	2(7)	0	18(60)	12(40)	1(3)	21(71)	8(26.7)	0	23(77)	7(23)
Setting priorities	10(33)	20(67)	4(13)	21(70)	5(16)	0	17(57)	13(43)	1(3)	22(73)	7(23)	0	24(80)	6(20)
Share use of resources	5(17)	25(83)	1(3)	21(70)	8(27)	0	13(43)	17(57)	2(7)	20(67)	8(27)	1(3)	21(70)	8(27)
Knowledge generation	20(67)	10(33)	4(13)	21(70)	5(17)	0	15(50)	15(50)	3(10)	19(63)	8(27)	1(3)	21(70)	8(27)
Joint implementation	12(40)	18(60)	3(10)	20(67)	7(23)	0	14(47)	16(53)	0	17(56)	13(43)	2(6.7)	18(60)	10(33)
Joint monitoring	12(40)	18(60)	4(13)	19(63)	7(23)	1(3)	13(43)	16(53)	0	18(60)	12(40)	3(10)	19(63)	8(27)
Joint feedback	14(47)	16(53)	5(16)	20(67)	5(17)	2(7)	13(43)	15(50)	0	18(60)	12(40)	3(10)	19(63)	8(27)
Joint extension service	6(20)	24(80)	4(13)	18(60)	8(27)	2(7)	10(33)	18(60)	0	17(58)	13(43)	3(10)	18(60)	9(30)
Joint use of sms for service providers	13(43)	17(57)	6(20)	18(60)	6(20)	2(7)	12(40)	16(53)	0	20(10)	10(33)	2(7)	20(67)	8(27)
Joint evaluation of trials	10(33)	20(67)	4(13)	17(57)	9(30)	2(7)	11(37)	17(57)	0	22(73)	8(27)	1(3)	22(73)	7(23)
Joint survey	11(37)	19(63)	3(10)	18(60)	9(30)	3(10)	12(40)	15(50)	0	17(57)	13(43)	1(3.3)	22(73)	7(23)
Joint workshop for extension personnel	25(83)	5(17)	5(17)	17(57)	8(27)	4(13)	11(37)	15(50)	0	17(57)	13(43)	5(17)	19(63)	6(20)
Joint research activities	3(10)	27(90)	1(3)	19(63)	10(33)	1(3)	11(37)	18(60)	0	17(57)	17(43)	1(3)	16(53)	13(43)
Joint field visits	19(63)	11(37)	6(20)	16(53)	8(27)	4(13)	14(47)	12(40)	0	18(60)	12(40)	3(10)	20(67)	7(23)

Dissemination of knowledge	12(40)	18(60)	1(3)	21(70)	8(27)	2(7)	15(50)	13(43)	0	16(53)	14(47)	1(3)	21(70)	8(27)
Joint seminars and workshops	25(83)	5(17)	6(20)	18(60)	6(20)	5(17)	13(43)	13(43)	1(3)	18(60)	11(37)	3(10)	20(67)	7(23)
Joint demonstration	16(53)	14(47)	5(17)	20(67)	5(17)	4(13)	14(47)	12(40)	1(3)	20(67)	9(30)	3(10)	20(67)	7(23)
Evaluation reports	9(30)	21(70)	1(3)	22(73)	7(23)	0	15(50)	15(50)	1(3)	18(60)	11(37)	0	22(73)	8(27)
Management capacity	9(30)	21(70)	1(3)	22(73)	7(23)	0	18(60)	12(40)	1(3)	19(63)	10(33)	0	25(85)	5(17)
Report publication	8(27)	22(73 &	0	22(73)	8(27)	0	13(43)	17(57)	2(7)	14(47)	14(47)	1(3)	19(63)	10(33)
Reward system	5(17)	25(83)	1(3)	16(53)	13(43)	0	13(43)	17(57)	1(3)	19(63)	10(33)	1(3)	23(76)	6(20)
Research contracts	4(13)	26(87)	1(3)	18(60)	11(37)	0	8(27)	22(73)	1(3)	17(57)	12(40)	0	21(70)	9(30)
Problem delineation	5(16.7)	25(83. 3	1(3.3)	19(63)	10(33)	0	11(37)	19(63)	1(3)	18(60)	11(37)	1(3)	19(63)	10(33)
Field days	25(83)	5(17)	6(20)	18(60)	6(20)	4(13)	11(37)	15(50)	1(3)	14(47)	15(50)	2(7)	20(67)	8(27)
Financial resources	8(26.7)	22(73)	3(10)	20(67)	7(23)	0	11(37)	19(63)	1(3)	16(53)	13(43)	1(3)	21	8(27)

\* R – Regularly, O – Occasionally, N – Never\* Figures in parenthesis are percentage

#### **4.4.5 Linkage activities of input dealers**

Table 6 presents linkage activities of input dealers with farmers, researchers, extension agents and marketers. The majority of input dealers were involved in joint planning (97%), joint training (90%) and workshop for extension personnel (80%). However, input dealers linkage activities with farmers include joint feedback (67%), joint demonstration (60%) and knowledge generation (57%). Involvement of input dealers is critical for accelerating farmer's access to agricultural inputs. Input dealers and researchers were occasionally involved in joint workshop (90%), joint problem diagnosis (87%), joint extension services and dissemination of knowledge (80%).

Table 6 shows that input dealers and extension agents were occasionally involved in joint training and extension service (93%). This occasional meeting might be attributed to the fact that extension agents have to first understand the needs of farmers in order to provide input dealers with exactly what farmers need. Jenson et al (2009) maintain that extension agents are a source of agricultural information used by farmers. Table 6 further shows that input dealers and marketers were regularly involved in knowledge generation (47%), share use of resources and dissemination of knowledge (43%) and joint planning (40%).

**Table 6: Linkage activities of input dealers**

Function	Y	N	Frequency with farmers			Frequency with researchers			Frequency with extension agents			Frequency with marketers		
			R	O	N	R	O	N	R	O	N	R	O	N
Problem diagnosis	22(73)	8(27)	11(37)	18(60)	1(3.3)	1(3)	26(87)	3(10)	2(7)	21(70)	7(23)	9(30)	18(60)	3(10)
Planning	29(97)	1(3)	11(37)	17(57)	2(6.7)	2(7)	12(40)	16(53)	1(3)	24(80)	5(17)	12(40)	18(60)	0
Joint training	27(90)	3(10)	11(37)	18(60)	1(3)	0	20(67)	10(33)	0	28(93)	2(7)	7(23)	23(77)	0
Setting priorities	20(67)	10(33)	13(43)	10(33)	7(23)	1(3)	17(57)	12(40)	0	20(67)	10(33)	11(37)	16(53)	3(10)
Share use of resources	19(63)	11(37)	16(53)	11(37)	3(10)	4(13)	9(30)	17(57)	0	28(93)	2(7)	13(43)	11(37)	6(20)
Knowledge generation	11(37)	19(63)	17(57)	12(40)	1(3)	10(33)	20(67)	0	3(10)	26(87)	1(3)	14(47)	14(47)	2(7)
Joint implementation	9(30)	21(70)	5(17)	16(53)	9(30)	1(3)	5(17)	24(80)	1(3)	20(67)	9(30)	3(10)	20(67)	7(2)
Joint monitoring	8(27)	22(73)	1(3)	17(57)	12(40)	3(10)	2(7)	25(83)	1(3)	11(37)	18(60)	2(7)	21(70)	7(23)
Joint feedback	14(47)	16(53)	20(67)	10(33)	0	6(20)	23(77)	1(3)	1(3)	25(83)	4(13)	6(20)	17(57)	7(23)
Joint extension service	14(47)	16(53)	7(23)	23(77)	0	4(13)	24(80)	2(7)	0	28(93)	2(7)	2(7)	26(87)	2(7)
Joint use of sms for service providers	20(63)	10(33)	8(27)	16(53)	6(20)	7(23)	16(53)	7(23)	0	29(97)	1(3)	1(3)	29(97)	0
Joint evaluation of trials	15(50)	15(50)	5(17)	19(63)	6(20)	1(3)	16(53)	13(43)	0	15(50)	15(50)	3(10)	18(60)	9(30)
Joint survey	14(47)	16(53)	6(20)	19(63)	5(16)	0	15(50)	15(50)	1(3)	15(50)	14(47)	0	21(70)	9(30)
Joint workshop for extension personnel	24(80)	6(20)	7(23)	21(70)	2(7)	2(7)	27(90)	1(3)	4(13)	26(87)	0	2(7)	26(87)	2(7)
Joint research activities	21(70)	9(30)	9(30)	20(67)	1(3)	5(17)	19(63)	6(20)	2(7)	26(87)	2(7)	6(20)	23(74)	1(3)
Joint field visits	15(50)	15(50)	8(27)	21(70)	1(3)	10(33)	14(47)	6(20)	2(7)	24(80)	4(13)	4(13)	25(83)	1(3)
Dissemination of	24(80)	6(20)	18(16)	9(30)	3(10)	5(17)	24(80)	1(3)	2(7)	24(80)	4(13)	13(43)	17(56)	0

knowledge														
Joint seminars and workshops	23(77)	7(23)	6(20)	24(80)	0	3(10)	25(83)	2(7)	6(20)	23(77)	1(3)	2(7)	24(80)	4(13)
Joint demonstration	20(63)	10(33)	18(60)	11(37)	1(3)	4(13)	12(40)	14(47)	4(13)	24(80)	4(13)	3(10)	25(83)	2(7)
Evaluation reports	19(63)	11(37)	10(33)	16(53)	4(13)	5(17)	19(63)	6(20)	3(10)	21(70)	6(10)	2(7)	18(60)	10(33)
Management capacity	12(40)	18(60)	3(10)	13(43)	14(46)	6(20)	8(27)	16(53)	0	10(33)	20(67)	4(13)	11(37)	15(50)
Report publication	11(37)	19(63)	5(17)	20(67)	5(17)	4(13)	17(57)	9(30)	0	24(80)	6(20)	2(7)	18(60)	10(33)
Reward system	9(30)	21(70)	3(10)	20(67)	7(23)	3(10)	6(20)	21(70)	0	15(50)	15(50)	4(13)	17(57)	9(30)
Research contracts	15(50)	15(50)	10(33)	17(57)	3(10)	8(27)	22(73)	0	0	25(83.3)	5(16.7)	6(20)	21(70.0)	3(10)
Problem delineation	15(50)	15(50)	10(33)	18(60)	2(7)	6(20)	23(77)	1(3)	2(7)	24(80)	4(13)	6(20)	21(70)	3(10)
Field days	22(73)	8(27)	4(13)	25(83)	1(3)	6(20)	23(77)	1(3)	2(7)	25(83)	5(17)	4(13)	17(57)	9(30)
Financial resources	22(73)	8(27)	16(53)	9(30)	5(17)	1(3)	10(33)	19(63)	1(3)	16(53)	13(43)	17(57)	11(37)	2(7)

\* R – Regularly, O – Occasionally, N – Never\* Figures in parenthesis are percentage

#### **4.5: Constraints to collaboration**

Collaboration comes in varied forms and is often derived out of a need to provide knowledge and skills. Collaboration evolves and may be terminated once the objectives of the stakeholders have been achieved or modified. Therefore, collaboration can either be rewarding or risky at the same time (Freeman, Ganguli and Murciano-Gorof, 2014).

Table 7 presents results of the study with regard to constraint faced by extension agents, farmers, researchers, input dealers and marketers. Extension agents indicated that their major constraints to collaboration as follows: Inadequate research staff (98%), lack of interest (93%), poor administration of research and extension institutions (93%), job tenure of extension agents (92%), inadequate finance for technologies (90%), no consultation (88%), lack of communication among stakeholders (88%), professional bias (85%), job tenure of researchers (85%), status among stakeholders (83%) and political issues influencing research and extension (83%). However, Farooq (2010) found that inadequate research staff, lack of teaching equipment / facilities, poor linkages between research and extension organisations as the main obstacle hindering collaboration. In addition, Ajani and Onwubuya (2013) maintain that inadequate numbers and qualifications of extension agents creates problems for extension agents to collaborate.

Prominent constraints to collaboration as ranked by farmers were as follows: Inadequate finance for technologies and conflicting ideas both at (97%), no consultation and no complement from colleagues (94%), lack of communication among stakeholders, isolation and scattered habitat of farmers and inappropriate technologies (87%). These problems prevent farmers from abiding with the advice of extension workers and hence tend to be left behind in the adoption of the innovation process. According to Apantaku (2006), factors identified by farmers are low encouragement, inadequate knowledge and skills.

Constraints ranked by researchers were as follows: Status among stakeholders (96%), poor administration of research and extension institutions, lack of recognition from colleagues both at (92%), job tenure of researchers (90%), conflicting ideas and limited resources (86%).

Ubfal (2010) found that private mechanisms of funding are not widespread in developing countries and public funding was found to be the option for researchers. He further identified poor infrastructure for scientific research.

Moreover, constraints ranked highest by input dealers were as follows: Inadequate finance for technology (93%), status among stakeholders (93%), professional bias (93%), poor administration of research and extension institutions (93%), conflicting ideas (90%), lack of recognition from colleagues (90%), lack of interest (87%), limited resources (87%) and key decision-makers difficult to contact (87%). Contrary to these findings, Jonas, Mairura and Ekisa (2008) found high transport costs due to poor infrastructure, lack of market information, lack of storage facilities and limited skills among input dealers as major constraints to collaboration.

Furthermore, constraints ranked highly by marketers were as follows: Political issues influencing research and extension, lack of recognition from colleagues, not aware of existing technology (87%), isolation and scattered habitat from farmers, inadequate research staff, poor administration of research and extension (83%). Antwi and Seahlodi (2011) found the problem of accessing the high value market as a constraint to collaboration.

**Table 7: Constraints to collaboration faced by extension agents, farmers, researchers,  
Input dealers and marketers**

Constraint	Extension agents		Farmers		Researchers		Input dealers		Marketers	
	Y	N	Y	N	Y	N	Y	N	Y	N
Inadequate extension staff	42 (70)	18 (30)	25(71)	10(27)	40(80)	10(20)	29(27)	1(3)	21(70)	9(30)
Inadequate farmer participation	35(58)	25(42)	6(17)	29(83)	19(38)	31(62)	13(43)	17(57)	22(73)	8(27)
Lack of information on new technology	25(42)	35(58)	13(37)	22(63)	24(40)	26(52)	17(57)	13(43)	22(73)	8(27)
Inadequate finance for technologies	54(90)	6(10)	34(97)	1(3)	34(68)	16(32)	28(93)	2(7)	22(73)	8(27)
Conflicting ideas	43(72)	17(28)	34(97)	1(3)	43(86)	7(14)	27(90)	3(10)	22(73)	8(27)
No consultation	53(88)	7(12)	33(94)	2(6)	38(76)	12(24)	21(70)	9(30)	21(70)	9(30)
Lack of communication among stakeholders	53(88)	7(12)	31(89)	4(11)	30(60)	20(40)	24(80)	6(20)	23(77)	7(23)
Status among stakeholders	50(83)	10(17)	28(80)	7(20)	48(96)	2(4)	28(93)	2(7)	23(77)	7(23)
Lack of complement from colleagues	41(68)	19(32)	33(94)	2(6)	40(80)	10(20)	19(63)	11(37)	23(77)	7(23)
Poor management	45(75)	15(25)	32(91)	3(9)	36(72)	14(28)	17(57)	13(43)	22(73)	8(27)
Lack of skilled staff	34(7)	26(43)	28(80)	7(20)	36(72)	14(28)	17(57)	13(43)	24(80)	6(20)
Isolation and scattered habitat of farmers	20(33)	40(67)	31(87)	4(11)	27(54)	23(46)	23(77)	7(23)	25(83)	5(17)
Lack of trust	48(80)	12(20)	19(54)	16(46)	34(68)	16(32)	26(87)	4(14)	23(77)	7(23)
Lack of interest	56(93)	4(7)	23(64)	12(34)	28(56)	22(44)	19(63)	11(37)	23(77)	7(23)
Inappropriate technologies	49(82)	11(18)	31(87)	4(11)	36(72)	14(28)	16(53)	14(47)	24(80)	6(20)
Professional bias	51(85)	9(15)	26(74)	9(30)	35(70)	15(30)	28(93)	2(7)	24(80)	6(20)
Limited resources	49(82)	11(18)	25(71)	10(29)	43(86)	7(14)	26(87)	4(14)	24(80)	6(20)
Inexperienced staff	49(82)	11(18)	27(77)	8(23)	37(74)	13(26)	22(73)	8(27)	24(80)	6(20)
Key decision makers difficult to contact	42 (70)	18 (30)	26(74)	9(26)	35(70)	15(30)	26(87)	4(14)	24(80)	6(20)
Unclear project scope	25(42)	35(58)	17(49)	18(51)	25(50)	25(50)	21(70)	9(30)	23(77)	7(23)
Lack of time	29(48)	31(52)	23(66)	12(34)	38(76)	12(24)	22(73)	8(27)	24(80)	6(20)
Different expectations	43(72)	17(28)	25(71)	10(29)	34(68)	16(32)	22(73)	8(27)	27(90)	3(10)
Job tenure of researchers	51(85)	9(15)	16(46)	19(54)	45(90)	5(10)	25(83)	5(17)	23(77)	7(23)
Job tenure of extension agents	55(92)	5(8)	24(67)	11(31)	40(80)	10(20)	24(80)	6(20)	23(77)	7(23)
Qualification of extension agents	45(75)	15(25)	21(60)	14(20)	40(80)	10(20)	14(47)	16(53)	23(77)	7(23)
Political issues influencing research & Extension	50(83)	10(17)	28(80)	7(20)	41(82)	9(18)	29(27)	1(3)	26(87)	4(13)
Inadequate research staff	59(98)	1(2)	17(49)	18(51)	11(22)	39(78)	29(27)	1(3)	25(83)	5(17)
Poor administration of research & extension institutions	56(93.3)	4(7)	22(63)	13(37)	46(92)	4(8)	28(93)	2(7)	25(83)	5(17)
Lack of recognition from colleagues	42 (70)	18 (30)	24(69)	11(31)	46(92)	4(8)	27(90)	3(10)	26(87)	4(13)
Not aware of new existing technologies	26(43)	34(57)	30(86)	5(14)	36(72)	14(28)	17(57)	13(43)	26(87)	4(13)
Lack of interest	42 (70)	18 (30)	20(57)	15(43)	32(64)	18(38)	25(83)	5(17)	24(80)	6(20)
Distance between research centres and extension	31(52)	29(48)	21(60)	14(40)	39(78)	11(22)	22(73)	8(27)	25(83)	5(17)

#### **4.6 Attitude to collaboration among extension agents, farmers, researchers, input dealers and marketers towards collaboration**

Attitude is an evaluative statement, it can either be positive or negative concerning people or an occasion and reflects how one feels about something. Ogunlade, Atibioke and Ladele (2012) posit that if the attitude of a person is known towards a given situation, it can be used in addition to other intervening variables to envisage and explain reactions of the person to that class. However, for the purpose of this study, attitude was measured as a pooled score and responses to 28 attitudinal statements made on a five point Likert scale of strongly agree (SA) = 5; Agree (A) = 4; Undecided (U) = 3, disagree (D) = 2, strongly disagree = 1. The following are responses of extension agents on their attitudes towards collaboration:

##### **4.6.1 Attitudes of extension agents towards collaboration**

Table 8, presents responses by extension agents to the attitude statements on collaboration. The results show that 50% of extension agents strongly agreed that collaboration with other organisations is important. This implies that extension agents believe that many voices with the same message may help strengthen the credibility of the organisation and make it more powerful. Okorley, Gray and Reid (2010) reported that extension organisations have to foster pluralistic extension system in order to ensure sustainable agricultural development and farm household security.

My organisation prefers working with other organisations (42%) is the next statement that was strongly ranked positive by extension agents. The reason for this might be that generally, extension can be applied to different areas of society such as industrial, health and educational sectors as well as agricultural and rural development.

However, extension agents disagreed on the statements that it is time consuming to get the right people (45%), there is no transparency in collaboration (47%) and there is lack of order in collaboration (52%). This shows that extension agents are keen to collaborate with other stakeholders in the innovation process. Murphey, Miller and Harlin (2011) reported that stakeholder collaboration has the potential to help clients in obtaining critical skills and knowledge from different sources.

**Table 8: Attitude of extension agents to collaboration**

	<b>Strongly agree</b>	<b>Agree</b>	<b>Undecided</b>	<b>Disagree</b>	<b>Strongly disagree</b>
Colleagues come with own bias	21(35)	35(58)	0	1(2)	3(5)
Colleagues have different ideas	18(30)	35(58)	1(2)	1(2)	5(8)
Not all stakeholders desire to collaborate	22(37)	35(58))	0	3(5)	0
There is duplication of efforts	10(17)	30(50)	11(18)	9(15)	0
No complement to each other	16(27)	35(58)	9(15)	0	0
Time consuming to get right people	0	24(40)	9(15)	27(45)	0
Misunderstanding may occur	0	40(67)	11(18)	9(15)	0
Other organisations are judged	0	37(62)	14(23)	9(15)	0
Other organisation's views are respected more than others	1(2)	34(55)	19(32)	6(10)	0
Some powerful stakeholders may refuse to participate	13(22)	35(58)	12(20)	0	0
Participants have may have more than one view in an issue	11(18)	42(70)	5(8)	2(3)	0
Collaboration with other organisations is important	30(50)	21(35)	8(13)	1(2)	0
Conflicts are difficult to resolve	5(8)	25(42)	11(18)	19(32)	0
All stakeholders may not have the necessary skills	15(25)	28(47)	5(8)	13(22)	0
No transparency	5(8.3)	12(20)	13(22)	28(47)	2(3)
Weakness of other organisations is shown	2(3.3)	27(45)	15(25)	16(27)	0
Some participants are unwilling to share their knowledge and expertise	10(17)	34(57)	12(20)	4(7)	0
Barriers among organisations are broken down	5(8)	17(28)	17(28)	21(35)	0
Not all organisations take collaborative efforts in decision making	8(13)	28(47)	11(18)	13(22)	0
I do not appreciate working with other people	6(10)	13(22)	9(15)	22(37)	10(17)
My organisation prefers working with other organizations	25(42)	16(27)	3(5)	14(23)	3(5)
Different institutions have different mandates	13(22)	35(58)	5(8)	7(12)	0
Collaboration is not within our scope of work	2(3)	13(22)	9(15)	21(35)	15(25)
Collaboration creates difficulty in setting rules	0	9(15)	20(33)	27(45)	4(7)
There is lack of order in collaboration	0	12(20)	16(7)	31(52)	1(2)
Collaboration reveals the weakness of other organisations	0	16(27)	20(33)	21(35)	3(5)
Collaboration helps breakdown bureaucratic barriers between organisations	2(2)	18(30)	18(30)	22(38)	0

#### **4.6.2 Attitude of farmers towards collaboration**

The results showing the attitude of farmers towards collaboration are presented in Table 9. Farmers strongly agree that colleagues come with own bias and have different ideas. Moreover, not all stakeholders have the desire to collaborate (60%) because the weakness of the other organisation is shown (40%). Farmers further agreed that other organisations are judged (83%). During the interview, farmers indicated that when many people are involved in performing tasks, others do not make inputs but at the end, they all share the credit. However, Pezeshki-Raad and Dehkordi (2006) found this as an important obstacle to linkage with other stakeholders.

In addition, (63%) of farmers agreed that collaboration with other organisations might be important. This might be because they hope that duties will be coordinated and there will be strong a relationship and manpower.

Table 9 Attitude of farmers to Collaboration

	Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
Colleagues come with own bias	21(60)	14(40)	0	0	0
Colleagues have different ideas	21(60)	14(40)	0	0	0
Not all stakeholders desire to collaborate	21(60)	14(40.0)	0	0	0
There is duplication of efforts	6(17)	23(66)	3(9)	3(9)	0
No complement to each other	3(9)	21(60)	6(17)	5(14)	0
Time consuming to get the right people	0	29(82)	5(14)	1(3)	0
Misunderstanding may occur	3(9)	21(60)	6(17)	5(14)	0
Other organisations are judged	0	29(83)	5(14)	1(3)	0
Other organisation's views are respected more than others	7(20)	27(77)	1(3)	0	0
Some powerful stakeholders may refuse to participate	4(14)	20(57)	11(31)	0	0
Participant have may have more than one view in an issue	8(23)	24(69)	2(6)	1(3)	0
Collaboration with other organisations is important	11(31)	22(63)	2(6)	0	0
Conflicts are difficult to resolve	12(34)	21(60)	2(6)	0	0
All stakeholders may not have the necessary skills	6(17)	28(80)	1(3)	0	0
No transparency	5(14)	20(57)	10(29)	0	0
Weakness of other organisations is shown	14(40)	18(51)	3(9)	0	0
Some participants are unwilling to share their knowledge and expertise	2(6)	27(77)	5(14)	1(3)	0
Barriers among organisations are broken down	4(11)	28(80)	2(6)	1(3)	0
Not all organisations take collaborative efforts in decision- making	9(26)	21(60)	4(11)	1(3)	0
I do not appreciate working with other people	6(17)	7(20)	7(20.0)	15(43)	0
My organisation prefers working with other organisations	9(26)	19(54)	5(14)	2(6)	0
Different institutions have different mandates	6(17)	9(26)	3(9)	17(47)	0
Collaboration is not within our scope of work	6(17)	19(54)	1(3)	9(26)	0
Collaboration creates difficulty in setting rules	11(31)	23(66)	1(3)	0	0
There is lack of order in collaboration	10(29)	5(14)	4(11)	16(46)	0
Collaboration reveals the weakness of other organisations	7(20)	16(46)	7(20)	5(14)	0
Collaboration helps breakdown bureaucratic barriers between organisations	7(20)	9(26)	16(46)	3(7)	0
Colleagues are unwilling to share resources with others	6(17)	16(46)	8(23)	4(11)	0

#### **4.6.3 Attitude of researchers to collaboration**

The results of researchers' response to attitude statements on collaboration are shown in Table 10 and rated on a 5 – point scale. The results revealed a negative attitude by researchers towards collaboration. The most prominent statements as ranked by researchers were statements that colleagues come with own bias (86%), colleagues have different ideas (84%), misunderstanding may occur (84%), participants may have one view in an issue (78%), all stakeholders may not have the necessary skills (78%), weakness of other organisations is shown (77%), different institutions have different mandates (74%), colleagues are unwilling to share resources with others (74%), not all stakeholders desire to collaborate (72%) and no complement for each other (72%). Pezeshki-Raad and Dehkordi (2006) found that the role of researchers, as the main generators of technologies and information, requires working closely and collaboratively with others. Thus lack of a linkage between agricultural research is one of the most important institutional constraints.

**Table 10: Attitude of researchers to collaboration**

	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
Colleagues come with own bias	1(2)	43(86)	2(4)	4(8)	0
Colleagues have different ideas	3(6)	42(84)	2(2)	1(2)	2(4)
Not all stakeholders desire to collaborate	12(24)	36(72)	2(4.0)	0	0
There is duplication of efforts	2(4)	28(56)	4(8)	16(32)	0
No complement to each other	3(6)	36(72.0)	2(4.0)	9(18.0)	0
Time consuming to get the right people	3(6)	22(44)	1(2)	23(46)	1(2)
Misunderstanding may occur	3(6)	42(84)	4(8)	1(2)	0
Other organisations are judged	4(8)	34(68)	7(14)	5(10)	0
Other organisation's views are respected more than others	10(20)	32(64)	6(12.0)	2(4)	0
Some powerful stakeholders may refuse to participate	7(14)	35(70)	7(14)	1(2)	0
Participants may have more than one view on an issue	7(14)	39(78)	4(8)	0	0
Collaboration with other organisations is important	22(44)	26(52)	2(4)	0	0
Conflicts are difficult to resolve	4(8)	26(52)	7(14)	12(24)	1(2)
All stakeholders may not have the necessary skills	8(16)	39(78)	2(2)	1(2)	0
No transparency	4(8)	26(52)	6(12)	14(28)	0
Weakness of other organisations is shown	3(6)	38(77)	5(10)	4(8)	0
Some participants are unwilling to share their knowledge and expertise	5(10)	33(66)	7(14)	4(8)	1(2)
Barriers among organisations are broken down	4(8)	25(50)	13(26)	8(16)	0
Not all organizations take collaborative efforts in decision -making	9(18)	29(58)	9(19)	2(4)	1(2)
I do not appreciate working with other people	2(4)	19(39)	9(18)	13(26)	7(14)
My organisation prefers working with other organisations	13(26)	33(66)	2(4)	0	1(2)
Different institutions have different mandates	10(20)	37(74)	1(2)	1(2)	1(2)
Collaboration is not within our scope of work	0	16(32)	3(6.0)	20(40)	11(22)
Collaboration creates difficulty in setting rules	2(4)	20(40)	1(2)	26(52)	1(2)
There is lack of order in collaboration	2(4)	17(34)	14(28)	16(32)	1(2)
Collaboration reveals the weakness of other organisations	0	28(56)	8(16)	13(26)	1(2)
Collaboration helps breakdown bureaucratic barriers between organisations	3(6)	36(72)	8(16)	3(6)	0
Colleagues are unwilling to share resources with others	3(6)	37(74)	4(8)	5(10)	1(2)

#### **4.6.4 Attitude of input dealers to collaboration**

Table 11 presents the attitude of input dealers to collaboration. Respondents strongly agree that participants may have more than one view on an issue (70%), some powerful stakeholders may refuse to participate (60%), all stakeholders may not have the necessary skills (60%), some participants are unwilling to share their knowledge and expertise, collaboration reveals the weakness of other organisations (60%), colleagues are unwilling to share resources with others (57%) and colleagues have different ideas (53%). These results show that input dealers have a negative attitude towards collaboration. However, Blum, Lowengart-Aycicegi and Magen (2010) found that input dealers have useful information on market conditions and credit opportunities. This may be the reason why they show less interest in collaborating.

**Table 11: Attitude of input dealers to collaboration**

	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
Colleagues come with own bias	5(17)	17(57)	1(3)	7(23)	0
Colleagues have different ideas	16(53)	13(43)	1(3)	0	0
Not all stakeholders desire to collaborate	16(53)	6(20.0)	7(23.3)	1(3.3)	0
There is duplication of efforts	8(27)	4(13)	10(33)	8(27)	0
No complement to each other	7(23)	13(43)	6(20)	4(13)	0
Time consuming to get the right people	3(10)	6(20)	13(43)	3(10)	5(17)
Misunderstanding may occur	9(30)	19(63)	1(3)	1(3)	0
Other organisations are judged	12(40)	8(27)	7(23)	3(10)	0
Other organisation's views are respected more than others	10(33)	8(27)	10(33)	1(3.3)	1(3)
Some powerful stakeholders may refuse to participate	18(60)	8(27)	1(3)	3(10)	0
Participants have may have more than one view on an issue	21(70)	8(27)	1(3)	0	0
Collaboration with other organisations is important	17(57)	10(33)	1(3)	2(7)	0
Conflicts are difficult to resolve	3(10)	12(40)	2(7)	12(40)	1(3)
All stakeholders may not have the necessary skills	18(60)	7(23)	2(7)	3(10.0)	0
No transparency	9(30)	9(30)	7(23)	4(13)	1(3)
Weakness of other organisations is shown	9(30)	12(40)	1(3)	6(20)	2(7)
Some participants are unwilling to share their knowledge and expertise	18(60)	8(27)	2(7)	1(3)	1(3)
Barriers among organisations are broken down	7(23)	8(27)	7(23)	6(20)	2(7)
Not all organisations take collaborative efforts in decision-making	14(47)	8(27)	2(7)	1(3)	5(17)
I do not appreciate working with other people	1(3)	9(30)	3(10)	8(27)	9(30)
My organisation prefer working with other organisations	7(23)	14(47)	4(13)	1(3)	4(13)
Different institutions have different mandates	13(43)	4(13)	3(10)	0	0
Collaboration is not within our scope of work	8(28)	4(13)	6(20)	9(30)	3(10)
Collaboration creates difficulty in setting rules	7(23)	11(37)	5(17)	7(23)	0
There is lack of order in collaboration	9(30)	5(17)	9(30)	7(23)	0
Collaboration reveals the weakness of other organisations	18(60)	10(33)	5(17)	5(17)	0
Collaboration helps breakdown bureaucratic barriers between organisations	15(50)	7(23)	6(20)	2(7)	0
Colleagues are unwilling to share resources with others	17(57)	10(33.)	1(3)	1(3)	1(3)

#### **4.6.5 Attitude of marketers to collaboration**

Table 12 presents marketers' response to attitude statements on collaboration. The results revealed discouraging negative attitudes by marketers towards collaboration. Among 28 attitudinal statements identified, marketers agreed on the statements that colleagues come with own bias (83%) and not all stakeholders desire to collaborate (80%). This gives a clear indication that marketers do not acknowledge the fact that collaboration can be prolific. Aphunu and Atoma (2010) found that marketers show unfavourable mood to collaborate with other stakeholders. Marketers further stated that their unwilling to collaborate was influenced by institutional problems such as lack of government support, poor extension services and lack of social and infrastructural facilities in the rural areas.

Table 12 Attitude of marketers to collaboration

	SA	A	U	D	SD
Colleagues come with own bias	4(13)	25(83)	1(3)	0	0
Colleagues have different ideas	25	4(13)	1(3)	0	0
Not all stakeholders desire to collaborate	4(13)	24(80)	2(6.7)	0	0
There is duplication of efforts	3(10)	23(77)	4(13)	0	0
No complement to each other	4(13)	18(60)	6(20)	2(7)	0
Time consuming to get right the people	2(7)	15(50)	10(33)	3(10)	0
Misunderstanding may occur	1(3)	19(63)	8(27)	2(7)	0
Other organisations are judged	0	20(67)	0	2(7)	0
Other organisation's views are respected more than others	3(10)	14(47)	11(37)	2(7)	0
Some powerful stakeholders may refuse to participate	6(20)	16(53)	7(23)	1(3)	0
Participants have may have more than one view in an issue	5(17)	17(57)	7(23)	1(3)	0
Collaboration with other organisations is important	7(23)	14(47)	5(17)	4(13)	0
Conflicts are difficult to resolve	6(20)	15(50)	8(27)	1(3)	0
All stakeholders may not have the necessary skills	5(17)	18(60)	6(20)	1(3)	0
No transparency	3(10)	22(73)	5(17)	0	0
Weakness of other organisations is shown	2(7)	23(77)	5(17)	0	0
Some participants are unwilling to share their knowledge and expertise	4(13)	21(70)	4(13)	1(3)	0
Barriers among organisations are broken down	3(10)	15(50)	11(37)	1(3)	0
Not all organisations take collaborative efforts in decision-making	4(13)	18(60)	8(27)	0	0
I do not appreciate working with other people	5(17)	13(43)	11(37)	1(3)	0
My organisation prefers working with other organisations	5(17)	18(60)	5(17)	3(10)	0
Different institutions have different mandates	4(13)	20(67)	4(13)	2(7)	0
Collaboration is not within our scope of work	3(10)	19(63)	6(20)	2(7)	0
Collaboration creates difficulty in setting rules	4(13)	17(57)	6(20)	3(10)	0
There is lack of order in collaboration	5(17)	16(53)	8(27)	1(3)	0
Collaboration reveals the weakness of other organisations	3(10)	19(63)	7(23)	1(3)	0
Collaboration helps breakdown bureaucratic barriers between organisations	1(3)	20(67)	9(30)	0	0
Colleagues are unwilling to share resources with others	2(7)	22(73)	5(17)	1(3)	0

#### **4.7 Knowledge of Agricultural Innovation system**

Knowledge is complex and commences when the individual is exposed to a new idea and gains understanding of how it works. According to Ogunlade, Atibioko and Ladele (2012), it is derived as a result of intensified, careful and systematic scientific investigation on natural phenomenon. They further classify knowledge as follows: Innovation (awareness) and knowledge and how-to knowledge and Principle knowledge. The how-to knowledge consists of information with and the quantity necessary to use an innovation properly. However, Davis (2009), remarks that agricultural productivity cannot be tackled if the capacity of actors is low. Capacity in terms of knowledge and information needs to be built in farmers and other stakeholders involved in agricultural value chain in order to enable them to operate efficiently in the ever changing economy.

Table 13 presents knowledge of agricultural system by extension agents, farmers, researchers, input dealers and marketers. The results show an overwhelming response by extension agents on knowledge of agricultural innovation system. Extension agents agreed that agricultural research, extension, education and training are key components of AIS (100%), plays an important role in developing human and social capital as well as in creating jobs (97%). They also believe that agricultural prosperity depends on new innovation because it is the application of knowledge and skills from different resources (87%). These results prove that extension agents are aware and knowledgeable about the agricultural innovation system because they believe in collaboration with different organisations in bringing about change in agriculture.

On the other hand, farmers displayed their knowledge and understanding of AIS by asserting as follows: It is a model through which information dissemination needs to be performed by different stakeholders (97%), AIS enables novel and positive experience (97%), it is a network of agents whose interaction determines the innovative impact of knowledge intervention (94%), agricultural innovation system is built on previous learning process (94%), it is the application of knowledge and skills from different resources (92%), plays an important role in developing human and social capital (92%), plays a role in job creation (92%), facilitates farmers access to markets (91%), education and training are the

components of AIS (91%). This shows that farmers support collaboration and that it will be fruitful to their livelihood when all actors trust each other and are prepared to work together in the innovation process.

Table 13 shows that agricultural input dealers are aware and knowledgeable about agricultural innovation system by agreeing as follows: That education and training are the components of agricultural innovation system (100%), it is built on the previous learning experience (100%) and enables novel and positive experience. Input dealers further agreed to collaborate on specific product to achieve a concrete goal (100). In addition, they further agreed that innovation system plays a vital role in generating income and poverty alleviation (96%), innovation is the application of knowledge and skills from different resources (93%), plays an important role in developing human and social capital as well as in job creation (93%) but requires a range of skills (80%). This suggests that input dealers believe a holistic, market-oriented approach helps to develop sustainable input supply system and allows them to accelerate the introduction of technology.

The majority of marketers indicated their knowledge of agricultural innovation system by agreeing as follows: Education and training are the components of AIS (97%), agricultural innovation system allows actors with different perspectives and interests to have access to the process (97%), agricultural prosperity depends on new innovation (93%), innovation is the application of knowledge and skills from different resources (93%), Innovation system plays an important role in developing human and social capital (93%).

**Table 13: Knowledge of agricultural innovation system by extension agents, farmers, Researchers, input dealers and marketers**

Statements	Extension agents		Farmers		Researchers		Input dealers		Marketers	
	T	F	T	F	T	F	T	F	T	F
Agricultural prosperity depends on new innovation.	52(87)	8(13)	14(40)	21(60)	33(66)	17(34)	20(67)	10(33)	28(93)	2(7)
Innovation is the application of knowledge and skills from different resources.	52(87)	8(13)	34(92)	1(2.9)	49(98)	1(2)	28(93)	2(3)	28(93)	2(7)
Innovation system plays an important role in developing human and social capital.	58(97)	2(3)	34(92)	1(3)	50(100)	0	28(93)	2(3)	28(93)	2(7)
AIS plays a role in job creation.	58(97)	2(3)	34(92)	1(3)	47(94)	3(6)	28(93)	2(3)	27(90)	3(10)
AIS play a vital role in generating income and poverty alleviation.	51(85)	9(15)	31(89)	4(11)	49(98)	1(2)	25(96)	5 (14)	27(90)	3(10)
AIS is a model in which information dissemination needs to be performed by different stakeholders.	51(85)	9(15)	34(97)	1(3)	48(96)	2(4)	28(93)	2(7)	27(90)	3(10)
AIS is a network of agents whose interaction determines the innovative impact of knowledge interventions.	45(75)	15(25)	33(94)	2(3)	47(94)	3(66)	23(77)	7(23)	26(87)	4(13)
AIS enhances the knowledge and skills of farmers.	53(88)	7(12)	30(86)	5(14)	49(98.0)	1(2)	29(97)	1(3)	25(83)	5(17)
Facilitates farmers' access to markets.	53(88)	7(12)	32(91)	3(9)	48(96)	2(4)	29(97)	1(3)	25(83)	5(17)
Agricultural research and extension are the key components.	60(100)	0	26(74)	9(26)	47(94)	3(6)	27(90)	3(10)	25(83)	5(17)
Farmers are not involved in the decision-making process.	33(55)	27(45)	23(66)	12(34)	17(34)	33(66)	10(33)	20(67)	28(93)	2(7)
AIS requires a range of skills.	50(83)	10(17)	27(77)	8(23)	45(90)	5(10)	24(80)	6(20)	2 (7)	28(93)
Education and training are the components of AIS.	60(100)	0	32(91)	3(9)	49(98)	1(2)	30(100)	0	29(97)	1(3)
People innovate in silos.	22(37)	38(63)	17(49)	18(51)	22(44)	28(56)	8(27)	22(73)	2(7)	28(93)
Allows actors with different										

perspectives and interests to have access to the process.	17(28)	43(72)	21(60)	14(40)	29(58)	21(42)	19(63)	11(37)	29(97)	1(3)
Actively integrates new participants.	13(22)	47(78)	21(60)	14(40)	33(66)	17(34)	19(63)	11(37)	28(93)	2(7)
Roles are clarified.	38(63)	22(37)	30(86)	5(14)	48(96)	2(4)	27(90)	3(10)	24(80)	6(20)
Personal relations are established.	24(40)	36(60)	26(74)	9(26)	33(66)	17(34)	18(60)	12(40)	27(90)	3(10)
Organise informal, bilateral meetings at the participants' location to get to know each other's life world.	12(20)	48(80)	20(57)	15(43)	34(68)	16(32)	14(47)	16(53)	28(93)	2(7)
Show commitment, engagement and sensitivity as facilitator.	53(88)	7(12)	32(91)	3(9)	48(96)	2(4)	28(93)	2(7)	28(93)	2(7)
Collaborating on a specific product to achieve concrete goals.	51(85)	9(15)	27(77)	8(22)	49(98)	1(2)	30(100)	0	27(90)	3(10)
Organising a situation where distinct actors are addressed as experts.	16(27)	44(73)	21(60)	14(40)	30(60)	20(40)	15(50)	15(50)	28(93)	2(3)
AIS is built on previous learning process.	46(77)	14(23)	33(94)	2(6)	47(94)	3(6)	28(93)	2(3)	28(93)	2(7)
AIS enables novel and positive experience.	47(78)	13(22)	34(97)	1(3)	50(100)	0	30(100)	0	27(90)	3(10)

#### **4.8 Comparison among AIS stakeholders on linkage, attitude and knowledge**

In Table 14, one way analysis of variance results show the difference in linkage, attitude and knowledge of agricultural innovation system among marketers, researchers, input dealers, farmers and extension agents in the North West Province. The F value for linkage = 41.817,  $P < 0.05$ ) shows that there is a significant difference among stakeholders with extension agents having the highest mean of 51.63. This is followed by marketers with the lowest mean of 37.16. This means that the higher number of extension agents, the more they can link with other stakeholders.

In Table 14, with one way analysis of variance, results show no difference in constraint among AIS stakeholders in North West Province. The F value for constraint shows that there is no significant difference among stakeholders in the North West Province.

In Table 14, with one way analysis of variance, results show a difference in attitude among AIS stakeholders in North West Province. The F value for attitude shows that there is a significant difference among stakeholders in the province with farmers having the highest mean of 110.65. This is followed by input dealers having the lowest mean of 107.13.

In Table 14, with one way analysis of variance, results show a difference in knowledge among AIS stakeholders in North West Province. The F value for knowledge shows that there is a significant difference among stakeholders in the province with marketers having the highest mean of 45.76; this is followed by extension agents having the lowest mean of 40.50.

**Table 14: One way ANOVA showing differences among marketers, researchers, input dealers, farmers and extension Agents in the North West Province**

	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG	GROUPS	N	MEAN
<b>LINKAGE</b> Btw groups	6133.213	4	1533.303	41.817	.000	Marketers	30	37.16 <sup>a</sup>
						Researchers	50	41.36 <sup>b</sup>
						Input dealers	30	42.80 <sup>b</sup>
						Farmers	35	50.02 <sup>c</sup>
						Extension agents	60	51.63 <sup>c</sup>
Within groups	7333.391	200	36.667					
<b>TOTAL</b>	13466.605	204						
<b>CONSTRAINT</b> Btw groups	157.833	4	39.458	1.173	.324	No significant difference ( Post-hoc not necessary )		
Within groups	6726.723	200	33.634					
<b>TOTAL</b>	6884.556	204						
<b>ATTITUDE</b> Btw groups	4782.783	4	1195.696	15.822	.000	Marketers	30	107.10 <sup>c</sup>
						Researchers	50	102.08 <sup>b</sup>
						Input dealers	30	107.13 <sup>c</sup>
						Farmers	35	110.65 <sup>c</sup>
						Extension agents	60	97.56 <sup>a</sup>
Within groups	15114.66	200	75.572					
<b>TOTAL</b>	19897.249	204						
<b>KNOWLEDGE</b> Btw groups	657.418	4	164.354	10.627	.000	Marketers	30	45.76 <sup>c</sup>
						Researchers	50	44.02 <sup>b,c</sup>
						Input dealers	30	42.63 <sup>b</sup>
						Farmers	35	43.02 <sup>b</sup>
						Extension agents	60	40.50 <sup>a</sup>
Within groups	3093.285	200	15.466					
<b>TOTAL</b>	3750.702	204						

## 4.9 Regression analysis

### 4.9.1 Determinants of collaboration among farmers

The multiple regression analysis showing the relationship between socio-economic characteristics and collaboration of farmers is presented in Table 15. The independent variables were significantly related to collaboration among farmers with an F value of 5.60. The R value of 0.94 showed that there was a strong correlation between the independent variables and collaboration. The results further predicted 88% of the variation in collaboration of farmers with extension agents, researchers, input dealers and marketers. Significant determinant were as follows: contact with extension agents ( $t = -3.622$   $p < 0.05$ ) and sources of credit ( $t = 2.49$   $p < 0.05$ ). Martey, Etwire, Wiredu and Dodbe (2011) observed that age of household, household head, household size and income significantly influence farmers' willingness to participate in the innovation platform. On the other hand, Zhang, Robinson and Wang (2010) found that education, age, amount of cultivated land, geographical location and farmers' perceived benefits and risk from wetland restoration were closely associated with farmers willingness to collaborate.

**Table 15: Multiple regression analysis showing the relationship between socio-economic Characteristics and collaboration of farmers**

	Unstandardized co-efficiencies		Standardized co-efficiencies	t	sig
	B	Std error	Beta		
Constant	-29.711	45.694		-.650	.525
Gender	-1.273	1.451	-.147	-.877	.394
Age	-.003	.089	-.009	-.038	.970
Marital status	-1.384	1.234	-.229	-1.093	.292
Household size	-.617	.427	-.248	-1.444	.169
Educational level	1.115	1.101	.245	1.013	.327
Experience	-.148	.183	-.271	-.810	.430
organisation	-1.129	.855	-.286	-1.320	.207
Contact with extension agents	-13.581	3.750	-.727	-3.622	.003
Distance from extension agents	.673	1.794	.122	.375	.713
Source of credit	1.599	.6.642	.387	2.492	.025
F	5.592				
P	.001				
R	.936				
R Square	.876				

#### **4.9.2 Regression analysis on collaboration among extension agents**

The results of the multiple regression analysis showing the relationship between socio-economic characteristics and collaboration of extension agents are depicted in Table 16. The independent variables were significantly related to collaboration among extension agents with an F value of 2.84. The R value of 0.75 showed that there was a strong correlation between independent variables and collaboration. The results predicted 56% variation of extension agents with farmers, researchers, input dealers and marketers. The highly significant determinant was as follows: Communities covered ( $t = -3.49, p < 0.05$ ). This result proves that extension agents effectively collaborate with other actors in order to deliver successful programmes. This is supported by Miller (2007) who maintains that extension agents have tools such as knowledge of the topic and resources to deliver programmes relevant to the communities. However, he suggests that proper training and preparation can enable extension agents to participate in programming, even if it is not within their expertise.

**Table 16: Multiple regression analysis showing the relationship between socio-economic characteristics and collaboration of extension agents**

	Unstandardized co-efficiencies		Standardized co-efficiencies	t	sig
	B	Std error	Beta		
Constant	71.796	11.429		6.282	.000
Gender	-1.032	1.109	-.183	-.930	.358
Age	.058	.074	.175	.795	.431
Marital status	.483	.603	.118	.801	.428
Household size	-.293	.278	-.156	-1.055	.298
Educational level	.519	.561	.184	.925	.361
Currently studying	-.919	.863	-.182	-1.066	.293
Experience	-.143	.075	-.381	-1.914	.063
Job location	1.000	.821	.173	1.218	.230
Communities covered	-.765	.219	-.566	-3.490	.001
Farmer group	.030	.472	.008	.064	.949
No of farmers covered	-.007	.005	-.175	-1.221	.229
F	2.84				
P	0.03				
R	.745				
R Square	.555				

The results of the multiple regression analysis showing the relationship between socio-economic characteristics and collaboration of researchers are shown in Table 17. The independent variables were significantly related to collaboration among researchers with an F value of 4.83. The R value of 0.86 showed that there was a strong correlation between independent variables and collaboration. Ragasa (2012) found that higher educational level was positively associated with collaboration in agricultural innovation system.

**Table 17: Multiple regression analysis showing the relationship between socio-economic characteristics and collaboration of researchers**

	Unstandardized Co-efficiencies		Standardized efficiencies	t	sig
	B	Std error	Beta		
Constant	-5.172	21.970		-.235	.815
Gender	1.433	2.573	.076	.557	.582
Age	.196	.187	.193	1.050	.302
Marital status	-1.147	2.326	-.072	-.493	.625
Household size	-.127	.904	-.022	-.140	.889
Educational level	.348	1.513	.032	.230	.819
Currently studying	-.976	1.816	-.059	-.537	.595
Experience	-.018	.224	-.018	-.081	.936
Job designation	3.266	3.199	.137	1.021	.315
Kind of Research organisation	2.509	1.839	.207	1.364	.182
Source of information	-3.826	2.891	-.218	-1.324	.195
F	4.833				
P	.000				
R	.859				
R Square	.737				

The results of the multiple regression analysis showing the relationship between socio-economic characteristics and collaboration of input dealers are shown in Table 18. The independent variables were significantly related to collaboration among input dealers with an F value of 2.34. The R value of 0.89 showed that there was a strong correlation between independent variables and collaboration. According to Seko (2009) household head age, active labor force of the family, access to market, extension contact and type of road used influenced collaboration.

In addition to this, factors that were found to be affecting collaboration by input dealers were: Organizational mandatory clarity, sufficient and irrigable seed farm, skilled man power, delay of loan settlement by users, policy environment, storage facilities at grass root level, efficient marketing system, timely demand claims from users, availability of improved seeds in terms of their germination, viability and adaptability, research centers cooperation and willingness to share resources including knowledge, farmers willingness to take risks and demand for improved crop varieties were some of mentioned factors that influenced collaboration.

**Table 18: Multiple regression analysis showing the relationship between socio-economic characteristics and collaboration of Input dealers**

	Unstandardized Co-efficiencies		Standardized	t	sig
	B	Std error	Beta		
Constant	-73.034	54.215		-1.347	.205
Gender	-2.838	3.024	-.178	-.939	.368
Age	.055	.239	.060	.230	.822
Marital status	-2.927	.2666	-.257	-1.098	.296
Household size	.700	.963	.173	.727	.482
Educational level	-1.156	1.049	-.182	-1.103	.294
Current studying	-3.403	3.041	-.221	-1.119	.287
Experience	.269	.278	.217	.969	.353
Dealership type	.342	1.546	.064	.221	.829
Source of products	2.145	1.567	.289	1.369	.198
Constraints with farm inputs	4.508	4.371	.270	1.031	.325
Location of business	.852	1.925	.088	.442	.667
F	2.346				
P	.076				
R	.891				
R Square	.793				

Table 19 presents the results of the multiple regression analysis showing the relationship between socio-economic characteristics and collaboration of marketers. The independent variables were significantly related to collaboration among marketers with an F value of 1.45. The R value of 0.84 showed that there was a strong correlation between independent variables and collaboration. Basheka (2007), Ntayi and Eyaa (2010) found that collaboration of marketers was influenced by: lack of concern for end customer, partial supply of items,

supply of substandard items, failure or refusal to supply, rejection of products and deferred payments.

**Table 19: Multiple regression analysis showing the relationship between socio-economic characteristics and collaboration of marketers**

	Unstandardized co-efficiencies		Standardized efficiencies	t	sig
	B	Std error	Beta		
Constant	96.449	41.739		2.311	.041
Gender	-.457	2.411	-.038	-.190	.853
Age	-.086	.223	-.153	-.387	.706
Marital status	-2.998	3.234	-3.53	-9.27	.374
Household size	2.122	2.054	.463	1.033	.324
Educational level	-4.878	4.568	-.264	-1.068	.308
Currently studying	-12.718	13.391	-.411	-.950	.363
Where purchasing goods	2.514	2.068	.274	1.215	.250
Distance to market	-.659	1.417	-.117	-.465	.651
Source of information	1.716	4.755	.135	.361	.725
Source of credit	-4.432	3.009	-.385	-1.473	.169
Location of business	-2.054	3.799	-.148	-.541	.599
F	1.453				
P	.267				
R	.839				
R Square	.804				

#### 4.10 Conclusion

A decision to adopt an innovation is influenced by age, educational level and socio-economic status. Chapter four has presented the results of the study in terms of the demographic characteristics of extension agents, researchers, farmers, input dealers and marketers, their linkage activities, constraints of stakeholders to collaboration, their attitude towards collaboration and finally their knowledge of agricultural innovation system. The next chapter presents the conclusion and recommendations.

## CHAPTER 5

### CONCLUSION AND RECOMMENDATIONS

#### 5.1 Introduction

The study revealed the structure of agriculture and extension in South Africa. It highlighted a range of stakeholders involved in providing and facilitating extension services. Furthermore, it reviewed different approaches used in agricultural innovation system, showed the linkage activities in different countries of the world and provided some conceptual models of innovation system. A summary of the key findings and gives recommendations based on the results are discussed below.

#### 5.2 Summary

The study assessed collaboration among farmers, extension agents, researchers, input dealers and marketers involved in the agricultural innovation system and identified their personal characteristics. It further examined the linkage activities these stakeholders are involved in. It also identified their constraints to collaboration, determined their attitude to collaboration and examined whether farmers, extension agents, researchers, input dealers and marketers are aware and knowledgeable about agricultural innovation system.

The study consisted of farmers affiliated to the North West Red Meat Producer Organisation (NWERPO), the National African Farmers Union (NAFU), the African Farmers Association of South Africa (AFASA), extension agents from Department of the Agriculture and Rural Development, researchers from the Agricultural Research Council (ARC) and the North West University, agricultural input dealers including North - Wes Kooperasie and Marketers of agricultural products. The study was conducted in all four districts of the province namely, Bojanala, Dr Kenneth Kaunda, Dr Ruth Segomotsi Mompati and Ngaka Modiri Molema. The sample size of the study was 205 participants (60 extension agents, 50 researchers, 35 farmers, 30 input dealers and 30 marketers). A structured questionnaire was used to gather information from selected respondents. The questionnaire consisted of six sections as follows: Demographic characteristics of respondents, linkage activities, constraints to collaboration and attitudes to collaboration and their knowledge of agricultural innovation

system. Data collected was analysed using the Statistical Product and Service Solution (SPSS). Frequency count percentages were used to analyse the data. Duncan multiple range test was used to assess collaboration among farmers, extension agent, researchers, input dealers and marketers.

### **5.3 Major findings of the study**

It was revealed that gender has an influence on the adoption of agricultural innovation in the North West Province as there are more males (65%) in farming than females (35%). The study also revealed a high percentage of unmarried extension agents (85%) compared to researchers (30%) and farmers (20%), input dealers (23%) and marketers 3% is unmarried. The results show that extension agents (52%), researchers (58%), farmers (58%), input dealers (73%), marketers (74%) all have a family of 3-5 members.

Linkage activities ranked high by extension agents are knowledge generation (92%), joint implementation (90%), management (88%), evaluation trials (80%), while farmers indicated their involvement in joint seminars and workshop (98%), joint demonstration (98%) and problem diagnosis (97%). Researchers stated their participation in knowledge dissemination (84%), joint seminars (72%), joint field visits (68%), problem diagnosis (66%) and field days (66%). The presence of researchers is a promising potential and has an unquestionable role in collaboration. Marketers were also involved in both joint training and planning (87%), problem diagnosis (83%) evaluation reports (73%), management (73%) and sharing of resources (70%). Input dealers were involved in joint feedback (67%), demonstration (60%) and knowledge generation (57%). Prevailing constraints to collaboration indicated by almost all respondents were as follows: Inadequate research staff (98%), poor administration (93%), job tenure of extension agents (90%), lack of communication among stakeholders (88%) and professional bias (85%).

### **5.4 Conclusion**

In order to realize an effective collaboration among farmers, extension agents, researchers, marketers and input dealers, their level of involvement in linkage activities need to be addressed. Based on the findings of the study, it could be concluded that there is an existing linkage among farmers, extension agents, researchers, marketers and input dealers, the extent

at which the linkages occur is rather low. Constraints that were ranked high by stakeholders may hinder further collaboration and should therefore be mitigated. Once there is effective and efficient collaboration in the agricultural sector, farmers will feel free to communicate their needs which will assist researchers and policy-makers in order to address them accordingly.

## **5.5 Recommendations**

The study identified factors affecting collaboration in agricultural innovation system by farmers, researchers, extension agents, input dealers and marketers in the North West Province of South Africa. Thus, collaboration enable organisations to extend and improve, their outreach abilities in order to serve the needs of farmers as possible. Lack of collaboration entails the duplication or rather repetition of efforts. To make agricultural growth and development effective through technology development and dissemination, this study recommends strategic collaboration among all stakeholders involved in the innovation system. It is of paramount importance that collaboration be institutionalized in order to ensure the sustainability of programmes. There is, however, a need to strengthen existing linkage activities among stakeholders. Agricultural research institutions need to ensure that researchers determine research priorities based on the needs of farmers, extension organisations as well need to ensure that results from research are translated to farmers through their assistance. According to some informants, effective collaboration can be ensured if collaborative strategies implemented are directed at different administrative levels.

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## **CERTIFICATE OF LANGUAGE EDITING**

The thesis entitled

**ANALYSIS OF STAKEHOLDERS' COLLABORATION IN  
AGRICULTURAL INNOVATION SYSTEMS IN THE NORTH WEST  
PROVINCE, SOUTH AFRICA**

Submitted by

**SINAH MODIRWA (16302338)**

For the degree

**DOCTOR OF PHILOSOPHY  
(Agricultural Extension)**

In the

**Faculty of Agriculture, Science and Technology  
Mafikeng Campus  
North-West University**

Has been edited for language by

**Paul Nepapleh Nkamta (PhD; MA; PGCE; BA Hons)**



**Paul Nepapleh Nkamta (PhD)**

**Questionnaire for: Analysis of stakeholders' collaboration in agricultural innovation system among farmers, extension officials, Researchers, input dealers and Marketers in North West Province, South Africa**

Dear respondents (**Farmers**)

This questionnaire is for data collection for farmers on collaboration in agricultural innovation system in the North West Province, South Africa. The information provided will be treated as confidential and no names are required. Analysis will be group referenced. May you please respond to the following questions.

**SECTION A: DEMOGRAPHIC CHARACTERISTICS**

1. Gender:      Male       Female
2. Age.....
3. Marital status  
     Single       Married       Divorced       Widowed
4. Please indicate your household size.....
5. Please indicate your religion  
     Christianity       Muslim       Hinduism       Islamic
6. Ethnic group  
     Black       Indian       Coloured       White   
     Other (specify).....
7. Highest educational level:  
     No formal education       Certificate       Diploma       Degree       Honors   
     Masters       PhD
8. Please indicate your farming experience (in years).....
9. Which enterprise(s) are you involved with?

<b>Crops</b>	<b>Farm size (HA)</b>	<b>Income(PM)</b>
Maize		
Sunflower		
Sorghum		
Wheat		
Tobacco		
<b>Vegetables:</b>		
Tomatoes		
Spinach		
Potatoes		
Onions		

Others.....		
<b>Animals</b>		
Cattle		
Sheep		
Goats		
Pigs		
Poultry		
Other (Specify) .....		

11. Which organization / association are you an affiliate of?

NAFU  AFASA  NERPO  NWERPO  Others.....

12. Do you have contact with extension agent? Y  N

13. Distance to extension offices. < 40km  40 – 100 km  > 100 km

14. What is your source of information?

Personal experience  Workshop/seminar  Friends and Neighbours

Magazines  Newspaper  Extension officers

Non-Government organizations  TV Broadcast  Radio Broadcast

Internet  Traditional Rulers/community leader  Journals

Other(specify).....

15. Indicate source of credit.

Bank  cooperative  Friends  Relatives  Insurance company  Other

(Specify).....

## SECTION B

Please indicate whether or not you participate in the following **linkage activities** and if you do, how frequent?

Regularly (R), Occasionally (O), Never (N)

Function	yes	no	Researcher			Extension			Marketer			Input dealer		
			R	O	N	R	O	N	R	O	N	R	O	N
Joint problem diagnosis														
Joint problem planning														
Joint training.														
Setting priorities														
Share use of resources														
Knowledge generation														
Joint implementation														



Not aware of new existing technologies		
Lack of interest		
Distance between research centers and extension offices		
Other (specify)		

Please reveal your **attitudes** towards collaboration

	Strongly agree	agree	Undecided	disagree	Strongly disagree
Colleagues come with their own biases.					
Colleagues have different ideas					
Not all stakeholders desire have ability, to collaborate					
There is duplication of efforts					
No complement to each other					
It is time consuming to get the right people					
Misunderstandings may occur					
Other organizations are judged					
organizations views are more respected than others					
some powerful stakeholders may refuse to participate,					
Participants may have more than one view in an issue					
Collaboration with other organizations is very important					
Conflicts are difficult to resolve.					
All stakeholders may not necessarily have the skills.					
No transparency					
Weakness of one's organization is shown					
Some participants are unwilling to share their knowledge and expertise.					
Barriers amongst organizations are broken down					
Not all organizations take collaborative efforts in decision making					
I do not appreciate with other people					
My organization prefer working with other organizations					
Different institutions have different mandates					
Collaboration is not within our scope of work					
Collaboration creates difficulty in setting rules					
There is lack of transparency in collaboration					
Collaboration reveals the weaknesses of an organization					
Collaboration helps breakdown bureaucratic barriers between organizations					
Colleagues are unwilling to share resources with others					

Please indicate your **knowledge** of Agricultural Innovation System (AIS)

Statement	True	False
Agricultural prosperity depends on new innovations		
Innovation is the application of knowledge and skills from different sources.		
Innovation system plays an important role in developing human, social capital.		
AIS play a role in job creation.		
AIS play a pivotal role in generating income and poverty alleviation.		
AIS is a model in which information dissemination need to be performed by different stakeholders.		
Is a network of agents whose interaction determines the innovative impact of knowledge interventions?		
Enhances the knowledge and skills of farmers		
Facilitates farmer's access to markets.		
Agricultural research and extension are the key component of AIS		
Farmers are not involved in the decision making process.		
AIS requires a range of skills		
Education and training are the components of agricultural innovation system		
People innovate in silos		
Allow actors with different perspectives and interests to have access to the process.		
Actively integrates new participants;		
Roles are clarified		
Personal relations are established		
Organising informal, bilateral meetings and meetings at the participants locations to get to know each other's' life-world;		
Show commitment, engagement and sensitivity as facilitator;		
Collaborating on a specific product, concrete goal;		
Organising situations where distinct actors are addressed as 'experts';		
Innovation system builds on previous learning processes.		
AIS enable novel and positive experiences.		

**Questionnaire for: Analysis of stakeholders' collaboration in agricultural innovation system among farmers, extension officials, Researchers, input dealers and Marketers in North West Province, South Africa**

Dear respondents (**Extension agents**)

This questionnaire is for data collection for extension agents on collaboration in agricultural innovation in the North West Province, South Africa. The information provided will be treated as confidential and no names are required. Analysis will be group referenced. May you please respond to the following questions.

**SECTION A: Demographic characteristics**

- 1 Gender: Male  Female
2. Age.....
3. Marital status  
Married  Divorced  Single  Widowed
4. Household size.....
5. Please indicate your religion  
Christianity  Muslim  Hinduism  Islamic
6. Ethnic group  
Black  Indian  Coloured  White  Other (specify).....
7. Highest educational level:  
Certificate  Diploma  Degree  Honors Masters  PhD
8. Are you currently studying for higher qualification?  
Yes  No
9. Please indicate your working experience (in Years).....
10. Are you living in your job location?  
Yes  No
11. What is your job designation?  
Agricultural technician  Senior agricultural technician   
Extension officer  Senior Extension officer
12. How many communities do you cover?.....
13. How many farmer groups are you involved with .....
14. Indicate the number of farmers covered.....
15. What is your source of information?  
Personal experience  Workshop/seminar  Friends and Neighbours   
Magazines  Newspapers  Extension officers   
Non-Government organizations  TV Broadcast  Radio Broadcast   
Internet  Traditional Rulers/community leader  Journals   
Other(specify).....

**SECTION B**

Please indicate whether you participate in the following **linkage activities** and if you do, how frequent?  
Regularly (R), Occasionally (O), Never (N)

Function	yes	no	Researcher			Farmer			Marketer			Input dealer		
			R	O	N	R	O	N	R	O	N	R	O	N
Joint problem diagnosis														
Joint problem planning														
Joint training														
Setting priorities														
Share use of resources														
Knowledge generation														
Joint implementation														
Joint monitoring														
Joint feedback														
Joint extension services														
Joint use of SMS for service providers														
Joint evaluation of trials														
Joint survey														
Workshop for extension personnel														
Joint research activities														
Joint field visits														
Dissemination of knowledge and information														
Joint seminar and workshop														
Joint demonstration														
Evaluation reports														
management capacity														
Report publications														
Reward system														
Joint research contracts														
Problem delineation														
Field days														
Financial resource														

2. Please indicate on the existing **constraints** to collaboration

Constraint	Yes	No
Inadequate extension staff		
Inadequate farmer participation		
Lack of information on new technologies		
Inadequate finance for technologies		
Conflicting ideas		
No consultation		
Lack of communication among other stakeholders		
Status among stakeholders		
Lack of complementation from colleagues		
Poor management		
Lack of skilled staff		
Isolation and scattered habitat of farmers		
Lack of trust		
Lack of interest		
Inappropriate technologies		
Professional bias		

Limited resources		
Inexperienced staff		
Key decision makers difficult to contact when issues arises		
Unclear project scope		
Lack of time		
Different expectations		
Job tenure of researchers		
Job tenure of extension agents		
Qualification of extension agents		
Political issues influencing research and extension		
Inadequate research staff		
Poor administration of research and extension institutions		
Lack of recognition from colleagues		
Not aware of new existing technologies		
Lack of interest		
Distance between research centers and extension offices		
Other (specify)		

3. Please reveal your **attitudes** towards collaboration

	Strongly agree	agree	Undecided	disagree	Strongly disagree
Colleagues come with their own biases.					
Colleagues have different ideas					
Not all stakeholders desire have ability, to collaborate					
There is duplication of efforts					
No complement to each other					
It is time consuming to get the right people					
Misunderstandings may occur					
Other organizations are judged					
organizations views are more respected than others					
some powerful stakeholders may refuse to participate,					
Participants may have more than one view in an issue					
Collaboration with other organizations is very important					
Conflicts are difficult to resolve.					
All stakeholders may not necessarily have the skills.					
No transparency					
Weakness of one's organization is shown					
Some participants are unwilling to share their knowledge and expertise.					
Barriers amongst organizations are broken down					
Not all organizations take collaborative efforts in decision making					
I do not appreciate to work with other people					
My organization prefer working with other organizations					
Different institutions have different mandates					

Collaboration is not within our scope of work					
Collaboration creates difficulty in setting rules					
There is lack of transparency in collaboration					
Collaboration reveals the weaknesses of an organization					
Collaboration helps breakdown bureaucratic barriers between organizations					
Colleagues are unwilling to share resources with others					

4. Please indicate your **knowledge** of Agricultural Innovation System (AIS)

Statement	True	False
Agricultural prosperity depends on new innovations		
Innovation is the application of knowledge and skills from different sources.		
Innovation system plays an important role in developing human, social capital.		
AIS play a role in job creation.		
AIS play a pivotal role in generating income and poverty alleviation.		
AIS is a model in which information dissemination need to be performed by different stakeholders.		
Is a network of agents whose interaction determines the innovative impact of knowledge interventions?		
Enhances the knowledge and skills of farmers		
Facilitates farmer's access to markets.		
Agricultural research and extension are the key component of AIS		
Farmers are not involved in the decision making process.		
AIS requires a range of skills		
Education and training are the components of agricultural innovation system		
People innovate in silos		
Allow actors with different perspectives and interests to have access to the process.		
Actively integrates new participants;		
Roles are clarified		
Personal relations are established		
Organising informal, bilateral meetings and meetings at the participants locations to get to know each other's' life-world;		
Show commitment, engagement and sensitivity as facilitator;		
Collaborating on a specific product and achieve concrete goal;		
Organising situations where distinct actors are addressed as 'experts'		
Innovation system builds on previous learning processes.		
AIS enable novel and positive experiences.		



13. Which Organization do you work for?

ARC  NWU  NGO

14. What is your MAIN source of information?

Personal experience  Workshop/seminar  Friends and Neighbours

Magazines  Newspapers  Extension officers

Non-Government organizations  TV Broadcast  Radio Broadcast

Internet  Traditional Rulers/community leader  Journals

Other(specify).....

**SECTION B**

Please indicate whether you participate in the following **linkage activities** and if you do, how frequent? Regularly (R), Occasionally (O), Never (N)

Function	yes no		Extension			Farmer			Marketer			Input dealer		
			R	O	N	R	O	N	R	O	N	R	O	N
Joint problem diagnosis														
Joint problem planning														
Joint training														
Setting priorities														
Share use of resources														
Knowledge generation														
Joint implementation														
Joint monitoring														
Joint feedback														
Joint extension services														
Joint use of SMS for service providers														
Joint evaluation of trials														
Joint survey														
Workshop for extension personnel														
Joint research activities														
Joint field visits														
Dissemination of knowledge and information														
Joint seminar and workshop														
Joint demonstration														
Evaluation reports														
management capacity														
Report publications														
Reward system														
Joint research contracts														
Problem delineation														
Field days														
Financial resource														

2. Please indicate on the existing **constraints** to collaboration

Constraint	Yes	No
Inadequate extension staff		
Inadequate farmer participation		
Lack of information on new technologies		
Inadequate finance for technologies		
Conflicting ideas		
No consultation		
Lack of communication among other stakeholders		
Status among stakeholders		
Lack of complementation from colleagues		
Poor management		
Lack of skilled staff		
Isolation and scattered habitat of farmers		
Lack of trust		
Lack of interest		
Inappropriate technologies		
Professional bias		
Limited resources		
Inexperienced staff		
Key decision makers difficult to contact when issues arises		
Unclear project scope		
Lack of time		
Different expectations		
Job tenure of researchers		
Job tenure of extension agents		
Qualification of extension agents		
Political issues influencing research and extension		
Inadequate research staff		
Poor administration of research and extension institutions		
Lack of recognition from colleagues		
Not aware of new existing technologies		
Lack of interest		
Distance between research centers and extension offices		
Other (specify)		
.....		
.....		

3. Please reveal your **attitudes** towards collaboration

	Strongly agree	agree	Undecided	disagree	Strongly disagree
Colleagues come with their own biases.					
Colleagues have different ideas					
Not all stakeholders desire have ability, to collaborate					
There is duplication of efforts					
No complement to each other					
It is time consuming to get the right people					
Misunderstandings may occur					
Other organizations are judged					
organizations views are more respected than others					
some powerful stakeholders may refuse to participate,					
Participants may have more than one view in an issue					
Collaboration with other organizations is very important					
Conflicts are difficult to resolve.					
All stakeholders may not necessarily have the skills.					
No transparency					

Weakness of one's organization is shown					
Some participants are unwilling to share their knowledge and expertise.					
Barriers amongst organizations are broken down					
Not all organizations take collaborative efforts in decision making					
I do not appreciate with other people					
My organization prefer working with other organizations					
Different institutions have different mandates					
Collaboration is not within our scope of work					
Collaboration creates difficulty in setting rules					
There is lack of transparency in collaboration					
Collaboration reveals the weaknesses of an organization					
Collaboration helps breakdown bureaucratic barriers between organizations					
Colleagues are unwilling to share resources with others					

4. Please indicate your **knowledge** of Agricultural Innovation System (AIS)

Statement	True	False
Agricultural prosperity depends on new innovations		
Innovation is the application of knowledge and skills from different sources.		
Innovation system plays an important role in developing human, social capital.		
AIS play a role in job creation.		
AIS play a pivotal role in generating income and poverty alleviation.		
AIS is a model in which information dissemination need to be performed by different stakeholders.		
Is a network of agents whose interaction determines the innovative impact of knowledge interventions?		
Enhances the knowledge and skills of farmers		
Facilitates farmer's access to markets.		
Agricultural research and extension are the key component of AIS		
Farmers are not involved in the decision making process.		
AIS requires a range of skills		
Education and training are the components of agricultural innovation system		
People innovate in silos		
Allow actors with different perspectives and interests to have access to the process.		
Actively integrates new participants;		
Roles are clarified		
personal relations are established		
Organising informal, bilateral meetings and meetings at the participants locations to get to know each other's' life-world;		
Show commitment, engagement and sensitivity as facilitator;		
Collaborating on a specific product, concrete goal;		
Organising situations where distinct actors are addressed as 'experts';		
Innovation system builds on previous learning processes.		
AIS enables novel and positive experiences.		

**Questionnaire for: Analysis of stakeholders' collaboration in agricultural innovation system among farmers, extension officials, Researchers, input dealers and Marketers in North West Province, South Africa**

Dear respondents (input dealers)

This questionnaire is for data collection for input dealers on collaboration in agricultural innovation in the North West Province, South Africa. The information provided will be treated as confidential and no names are required. Analysis will be group referenced. May you please respond to the following questions?

**SECTION A: DEMOGRAPHIC CHARACTERISTICS**

1. Gender Male  Female
2. Age.....
3. Marital status  
Single  Married  Divorced  Widowed
4. Please indicate your household size.....
5. Please indicate your religion  
Christianity  Muslim  Hinduism  Islamic
6. Ethnic group  
Black  Indian  Coloured  White   
Other(specify).....
7. Highest educational level:  
Certificate  Diploma  Degree  Honors  Masters  PhD
8. Are you currently studying for a higher degree?  
Yes  No
9. Please indicate your working experience..... (in years?)
10. Indicate your dealership type  
Stockist  Wholesales  Table top dealer  Sole ownership  Partnership
11. Indicate the products that you sell  
Fertilizers  Chemicals  Seeds  Machinery and equipment's   
Animal feed  Other (specify).....
12. Indicate the main source of your products.....  
Local dealers  Farmers  Manufacturers  Independent consultant   
Extension agent  Other (specify).....
13. Do you face any constraints associated with farm input sales?  
Y  N
14. What is the location of your business from farmers?  
< 40km    40-100km    > 100km

15. What is your source of information?

Personal experience  Workshop/seminar  Friends and Neighbours

Magazines  Newspapers  Extension officers

Non-Government organizations  TV Broadcast  Radio Broadcast

Internet  Traditional Rulers/community leader  Journals

Other(specify).....

16. Indicate source of credit.

Bank  cooperative  Friends  Relatives

Insurance company  Other (Specify).....

**SECTION B**

Please indicate whether you participate in the following **linkage activities** and if you do, how frequent? Regularly (R), Occasionally (O), Never (N)

Function	yes	no	Researcher			Farmer			Marketer			Extension		
			R	O	N	R	O	N	R	O	N	R	O	N
Joint problem diagnosis														
Joint problem planning														
Joint training														
Setting priorities														
Share use of resources														
Knowledge generation														
Joint implementation														
Joint monitoring														
Joint feedback														
Joint extension services														
Joint use of SMS for service providers														
Joint evaluation of trials														
Joint survey														
Workshop for extension personnel														
Joint research activities														
Joint field visits														
Dissemination of knowledge and information														
Joint seminar and workshop														
Joint demonstration														
Evaluation reports														
management capacity														
Report publications														
Reward system														
Joint research contracts														
Problem delineation														
Field days														
Financial resource														

2. Please indicate on the existing **constraints** to collaboration

Constraint	Yes	No
Inadequate extension staff		
Inadequate farmer participation		
Lack of information on new technologies		
Inadequate finance for technologies		
Conflicting ideas		
No consultation		
Lack of communication among other stakeholders		
Status among stakeholders		
Lack of complementation from colleagues		
Poor management		
Lack of skilled staff		
Isolation and scattered habitat of farmers		
Lack of trust		
Lack of interest		
Inappropriate technologies		
Professional bias		
Limited resources		
Inexperienced staff		
Key decision makers difficult to contact when issues arises		
Unclear project scope		
Lack of time		
Different expectations		
Job tenure of researchers		
Job tenure of extension agents		
Qualification of extension agents		
Political issues influencing research and extension		
Inadequate research staff		
Poor administration of research and extension institutions		
Lack of recognition from colleagues		
Not aware of new existing technologies		
Lack of interest		
Distance between research centers and extension offices		
Other (specify)		
.....		
.....		

3. Please reveal your **attitudes** towards collaboration

	Strongly agree	agree	Undecided	disagree	Strongly disagree
Colleagues come with their own biases.					
Colleagues have different ideas					
Not all stakeholders desire have ability, to collaborate					
There is duplication of efforts					
No complement to each other					
It is time consuming to get the right people					
Misunderstandings may occur					
Other organizations are judged					
organizations views are more respected than others					
some powerful stakeholders may refuse to participate,					
Participants may have more than one view in an issue					
Collaboration with other organizations is very important					
Conflicts are difficult to resolve.					
All stakeholders may not necessarily have the skills.					
No transparency					

Weakness of one's organization is shown					
Some participants are unwilling to share their knowledge and expertise.					
Barriers amongst organizations are broken down					
Not all organizations take collaborative efforts in decision making					
I do not appreciate with other people					
My organization prefer working with other organizations					
Different institutions have different mandates					
Collaboration is not within our scope of work					
Collaboration creates difficulty in setting rules					
There is lack of transparency in collaboration					
Collaboration reveals the weaknesses of an organization					
Collaboration helps breakdown bureaucratic barriers between organizations					
Colleagues are unwilling to share resources with others					

4. Please indicate your knowledge of Agricultural Innovation System (AIS)

Statement	True	False
Agricultural prosperity depends on new innovations		
Innovation is the application of knowledge and skills from different sources.		
Innovation system plays an important role in developing human, social capital.		
AIS play a role in job creation.		
AIS play a pivotal role in generating income and poverty alleviation.		
AIS is a model in which information dissemination need to be performed by different stakeholders.		
Is a network of agents whose interaction determines the innovative impact of knowledge interventions?		
Enhances the knowledge and skills of farmers		
Facilitates farmer's access to markets.		
Agricultural research and extension are the key component of AIS		
Farmers are not involved in the decision making process.		
AIS requires a range of skills		
Education and training are the components of agricultural innovation system		
People innovate in silos		
Allow actors with different perspectives and interests to have access to the process.		
Actively integrates new participants;		
Roles are clarified		
Personal relations are established		
Organising informal, bilateral meetings and meetings at the participants locations to get to know each other's' life-world;		
Show commitment, engagement and sensitivity as facilitator;		
Collaborating on a specific product, concrete goal;		
Organising situations where distinct actors are addressed as 'experts';		
Innovation system builds on previous learning processes.		
AIS enable novel and positive experiences.		

**Questionnaire for: Analysis of stakeholders' collaboration in agricultural innovation system among farmers, extension officials, Researchers, input dealers and Marketers in North West Province, South Africa**

Dear respondents (**Marketers**)

This questionnaire is for data collection for marketers on collaboration in agricultural innovation in the North West Province, South Africa. The information provided will be treated as confidential and no names are required. Analysis will be group referenced. May you please respond to the following questions.

**SECTION A: DEMOGRAPHIC CHARACTERISTICS**

- 1 Gender: Male  Female
2. Age.....
3. Marital status  
Married  Divorced  Single  Widowed
4. Indicate your household size.....
5. Please indicate your religion  
Christianity  Muslim  Hinduism  Islamic   
Other (specify).....
6. Ethnic group  
Black  Indian  Coloured  White   
Other (specify).....
7. Highest educational level:  
Certificate  Degree  Honors  Masters  PhD  other.....
8. Are you currently studying for higher qualification?  
Yes  No
9. Where do you purchase the products?  
Farmers  Traders  Local Markets  Distributors  Wholesale other.....
10. Indicate the distance to the market  
40km  80km  120km  180km  >180km
11. Do you have problems in accessing products yes  No
12. What is your source of information?  
Personal experience  Workshop/seminar  Friends and Neighbours   
Magazines  Newspapers  Extension officers   
Non-Government organizations  TV Broadcast  Radio Broadcast   
Internet  Traditional Rulers/community leader  Journals   
Other(specify).....
13. Indicate source of credit.  
Bank  cooperative  Friends  Relatives   
Insurance company  Other (Specify) .....

**SECTION B**

Please indicate whether you participate in the following linkage activities and if you do, how frequent? Regularly (R), Occasionally (O), Never (N)

Function	yes	no	Researcher			Farmer			Extension			Input dealer		
			R	O	N	R	O	N	R	O	N	R	O	N
Joint problem diagnosis														
Joint problem planning														
Joint training														
Setting priorities														
Share use of resources														
Knowledge generation														
Joint implementation														
Joint monitoring														
Joint feedback														
Joint extension services														
Joint use of SMS for service providers														
Joint evaluation of trials														
Joint survey														
Workshop for extension personnel														
Joint research activities														
Joint field visits														
Dissemination of knowledge and information														
Joint seminar and workshop														
Joint demonstration														
Evaluation reports														
management capacity														
Report publications														
Reward system														
Joint research contracts														
Problem delineation														
Field days														
Financial resource														

2. Please indicate on the existing **constraints** to collaboration

Constraint	Yes	No
Inadequate extension staff		
Inadequate farmer participation		
Lack of information on new technologies		
Inadequate finance for technologies		
Conflicting ideas		
No consultation		
Lack of communication among other stakeholders		
Status among stakeholders		
Lack of complementation from colleagues		
Poor management		
Lack of skilled staff		
Isolation and scattered habitat of farmers		
Lack of trust		
Lack of interest		
Inappropriate technologies		
Professional bias		
Limited resources		
Inexperienced staff		
Key decision makers difficult to contact when issues arises		
Unclear project scope		
Lack of time		

Different expectations		
Job tenure of researchers		
Job tenure of extension agents		
Qualification of extension agents		
Political issues influencing research and extension		
Inadequate research staff		
Poor administration of research and extension institutions		
Lack of recognition from colleagues		
Not aware of new existing technologies		
Lack of interest		
Distance between research centers and extension offices		
Other (specify)		
.....		

3. Please reveal your **attitudes** towards collaboration

	Strongly agree	agree	Undecided	disagree	Strongly disagree
Colleagues come with their own biases.					
Colleagues have different ideas					
Not all stakeholders desire have ability, to collaborate					
There is duplication of efforts					
No complement to each other					
It is time consuming to get the right people					
Misunderstandings may occur					
Other organizations are judged					
organizations views are more respected than others					
some powerful stakeholders may refuse to participate,					
Participants may have more than one view in an issue					
Collaboration with other organizations is very important					
Conflicts are difficult to resolve.					
All stakeholders may not necessarily have the skills.					
No transparency					
Weakness of one's organization is shown					
Some participants are unwilling to share their knowledge and expertise.					
Barriers amongst organizations are broken down					
Not all organizations take collaborative efforts in decision making					
I do not appreciate to work with other people					
My organization prefer working with other organizations					
Different institutions have different mandates					
Collaboration is not within our scope of work					
Collaboration creates difficulty in setting rules					
There is lack of transparency in collaboration					
Collaboration reveals the weaknesses of an organization					
Collaboration helps breakdown bureaucratic barriers between organizations					
Colleagues are unwilling to share resources with others					

4. Please indicate your **knowledge** of Agricultural Innovation System (AIS)

Statement	True	False
Agricultural prosperity depends on new innovations		
Innovation is the application of knowledge and skills from different sources.		
Innovation system plays an important role in developing human, social capital.		
AIS play a role in job creation.		
AIS play a pivotal role in generating income and poverty alleviation.		
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Is a network of agents whose interaction determines the innovative impact of knowledge interventions?		
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Farmers are not involved in the decision making process.		
AIS requires a range of skills		
Education and training are the components of agricultural innovation system		
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Show commitment, engagement and sensitivity as facilitator;		
Collaborating on a specific product and achieve concrete goal;		
Organising situations where distinct actors are addressed as 'experts'		
Innovation system builds on previous learning processes.		
AIS enable novel and positive experiences.		

