

Factors Hindering the Linkage of Farmers with Researchers in Agricultural Research in Ethiopia: From Agricultural Innovation System Perspectives

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Agriculture is the backbone of Ethiopian economy. However, many factors are limiting agricultural development emanating from loose linkage of researchers with farmers, weak institutional and technical innovation. Therefore, the objective of this research was to examine critical factors that hindered the linkage of researchers with farmers in agricultural research. A qualitative research design was used. Triangulation between different data sources took place to ensure validity. Respondents were identified through snowball sampling and in-depth interviews were held. Interviews were transcribed, translated and coded applying principles of grounded theory before it was descriptively analysed. The research results obtained from this research revealed that linkage of researchers with farmers was hindered by the type of research; farmers' experience in the past; integration of indigenous and scientific knowledge; farmers' attitude for research and researchers; priority setting; knowledge & skill to conduct demand-driven research; scientists' perception for farmers and attitude of scientists' about participation. The conclusions obtained from this research indicated that the type of research was basic; farmers had bad experiences in the past from agricultural research; the integration of indigenous knowledge with scientific knowledge was very weak and farmers perceived research as a complex and difficult process to work with researchers.


Key Words: Ethiopia; farmers; linkage; innovation; participation; agriculture

Introduction

Agriculture is the backbone of Ethiopian economy. However, many factors are holding back agricultural development to bring food security emanating from rapid population growth, adverse environmental conditions, loose linkage of researchers with farmers, weak institutional and technical innovation. Hence, in order to ensure agricultural as well as economic development of the country, agricultural innovation, strong linkage¹ of researchers with farmers, new approaches and practices have to be developed to pave for transformed commercial and modern agriculture. To bring development in agricultural sector, agricultural research has a critical role in stimulating modernization and development (Aberra and Fasil, 2005; Belay, 2008; Bayissa and Mansingh, 2015).

Ethiopian economic development is guided by Agricultural Development Led-Industrialization strategy (ADLIS) which was formulated in 1991 to

bring sustainable development. According to this strategy, agriculture is the base for the development of industry. This strategy helps pastoralists and farmers to use modern agricultural technologies effectively and efficiently so as to increase production and productivity in sustainable manner. In accordance with this strategy, the government has devoted extensive resources in agricultural research, industries and input supplies. The government has put great effort to increase agricultural production and productivity. Food insecurity and degradation of natural resources have been the major challenges to the economic development of Ethiopia.

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To alleviate these problems and to increase stakeholders' participation in agricultural development, Agriculture Growth Program (AGP) has been designed. AGP gives due attention to develop and strengthen pertinent institutions for agricultural growth in relation to agricultural innovation, skill development and working facilities.

Among the key institutions identified for AGP intervention is Agricultural Development Partners Linkage Advisor Council (ARDPLAC). Effective agricultural development in a sustainable manner requires a strong linkage among all actors particularly between research and farmers so as to promote agricultural development. However, the expected benefits, augmentation in agricultural output, have not been achieved due to weak linkage of researchers with farmers in the country (Woodhill et al., 2011).

Growing the productivity of smallholder farmers in Asia, Africa and Latin America has been called the best wager for global food security in 2050 (Hounkonnou et al., 2012). To bring sustainable development, African countries agreed on the conception that agriculture must be the 'motor of sustainable economic growth'. Moreover, there are great expectations that research will be the foremost source of the fuel - in terms of technology and knowledge - for this motor (Sumberg, 2005).

Circumstantial Of the Problem: Agricultural Research within the Context of Ethiopian Innovation System

Historical background of agricultural research system in Ethiopia

The beginning of agricultural research in Ethiopia dates back to the 1930s and even before. Earlier to this time, activities focused on germplasm collection, scientific expeditions, characterization and identification of crops. The introduction of exotic wheat germplasm and testing under local situations began in the early 1930s in Ethiopia. But until the early 1950s formal national research programme was not established. The commencement of formal research in agriculture began with the establishment of Ambo and Jimma Agricultural College in 1947 (now Ambo University and Jimma University respectively) and then Imperial College of Agriculture and Mechanical Arts (IECAMA) (now Haromaya Univeristy) central experiment station at Debre Zeit (known this time Debre Zeit Agricultural Research Centre) in 1955. In the decade following its formation, IECAMA was active in building the national agricultural research systems. The college and its central experimental station at Debre Zeit had a national obligation to conduct and organize agricultural research. The government shifted the responsibility for research in agriculture to the newly established Institute of Agricultural Research (IAR). The

establishment of the institute marked a start of institutionalized and coordinated agricultural research in Ethiopia in February 1966 with a mandate to frame the country's agricultural research policy to conduct research on livestock, natural resources, crops and related disciplines in the country under different agro ecological zones and to coordinate national agriculture. With the setting up of IAR, agricultural research, agricultural higher education and extension split up and were made answerable to three different and self-governing organizational structures. This structural change squeezed the linkage among the split structures (Aberra and Fasil, 2005).

Problems with the support of agricultural research system to innovation in Ethiopia

Since the beginning of IAR, the research system in the country was based on conventional research approaches that are discipline based, commodity oriented and transferred by a linear transfer model. Hence it was top-down research approach; farmers have little participation in the research process. Technologies that are developed with limited involvement of farmers are not usually relevant to farmers since there is little opportunity to consider the agro-ecological circumstances and socio-economics of the end users. There has been increasing dissatisfaction with the poor rates of adoption of agricultural technologies for resources poor farmers. This poor adoption has resulted as technologies are developed with little input from poor farmers (Aberra and Fasil, 2005). Low agricultural productivity is one of the major problems for food insecurity in Ethiopia emanating from the use of traditional farming practices, natural hazards like drought, lack of appropriate technologies for farmers, low adoption of agricultural innovations, irrelevance of the technologies to farmers need, poor access to market and weak linkage of researchers with farmers. Weak linkage of researchers with farmers resulted in weak technical and institutional innovation (Belay, 2008; IFAD, 2009; Spielman, Davis et al. 2011; Abate, Shiferaw et al., 2011; Wigboldus, Seerp, et al., 2011).

Belay (2008) argued that agricultural research lacks proper linkage between researchers among research institutes. Lack of proper coordination between Federal and Regional agricultural research institutes and Agricultural Institutes of Higher Education (AIHE), has resulted in duplication of efforts resulting in wastage of resources in the country. AIHE has the obligations majorly to involve in training of manpower (75% of the work load) besides conducting research in agriculture (25% of the work load) forming linkage with farmers. The major problems of researchers are that they address topics of their own interest for publication which has less relevance to the needs of farmers. Moreover, lack of research facilities, incentives, and at-

tractive payment reduced the initiatives of researchers to make good linkage with farmers to conduct solution oriented research. In Ethiopia, knowledge institutions have weak linkage with sister institutions and other organizations. Consequently, this weak relationship seriously affected the inter-institutional links. It is essential that this knowledge institutes² establish firm and strong linkages among themselves and also work in close collaboration with local farmers to bring innovation in the agricultural and sustainable development. The Ethiopian agricultural research developed many technologies. However, these technologies had limited impact on the lives of farmers. The causes for the limited impact includes lack of coordination and integration between research and extension; loose link between researchers and farmers; little feedback from farmers to researchers; irrelevance of research for farmers; lack of farmers participation in research process.

Problems facing universities working their research in agriculture and associated fields are many even though it differs from one institution to another. According to Belay (2008) the major problems identified in knowledge institute (university) are shortage of competent, highly qualified and experienced staff; shortage of laboratory materials to conduct demand driven research; weak practical training; research and teaching with little relevance to the Ethiopian environment; weak inter-institutional linkage; and lack of effective communication with key stakeholders in the country.

In general, low production and food insecurity in Ethiopia is caused by a number of factors. These factors include lack of strong and effective linkage between researchers and farmers; weak agricultural innovation; fragile linkage between researchers among the knowledge institutes; loose linkage of knowledge institutes with sister institutions; linear model of technology development and transfer; unfavourable institutional conditions; limited impact of technologies on the lives of the beneficiaries and irrelevance of research for farmers. Therefore, the objective of this research was to examine critical factors that hindered effective linkage of knowledge institutes with farmers in agricultural research in Ethiopia. The research findings hope to inform recommendations to policy makers and public authorities to contribute to solve practical problems which have limited innovation in agriculture at grassroots level.

Theoretical Framework

Agricultural innovation system (AIS) perspective was used as a theoretical framework to guide this research as linkage is the attribute of agricultural innovation system.

Concepts of innovation systems

Conventional approaches to agricultural development in Ethiopia have tended to regard innovation as the result of research, and see its dissemination as linear technique limited to researchers, extension staff and farmers. This does not result in increasing agricultural production and productivity and resulted in food insecurity. The research findings, once packaged for extension workers, are expected to be inherently suited to transfer to farmers in which farmers do not learn from the production of knowledge since they are not involved. Researchers have been separated from farmers in production of knowledge and technology. This is due to lack of direct linkage between researchers and farmers in knowledge and technology production, diffusion and utilization. More recent approaches to improving the impact of research on farmers live through effective collaboration put greater emphasis on partnership in which researchers do have strong linkage with farmers to conduct research which is relevant to farmers need to alleviate poverty (Klerkx et al., 2012).

Different methods have been used to increase agricultural output to feed the growing world population. Agricultural innovation has been started before 40 years in different approaches. Induced Innovation, Training and Visit System, Transfer of Technology system, Participatory Research and Participatory Technology Development, Farmer First, Agricultural Knowledge and Information Systems and Agricultural Innovation Systems are some of the different agricultural innovation approaches to increase agricultural productivity to alleviate poverty (Klerkx et al., 2012). AIS is the most recent thinking in a family of systems approach. It gives an understanding of the different actors and other factors which determine innovation in agriculture to increase agricultural output. It gives holistic approach to the study of agriculture to increase yield beyond research activities (Klerkx et al., 2012; Brooks and Loevinsohn 2011). Theoretically, AIS gives due attention to the relevant actors for a co-development process of innovation in agriculture. AIS is defined as “a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect the way different agents interact, share, access, exchange and use knowledge” (Hall et al. 2006: vi –vii). Innovation systems are composed of interrelated parts working for a common goal. AIS is an interconnected components of individual, institutions and organizations collaborating to generate, utilize and diffuse knowledge and technology for its economic value.

Innovation can be conceptualized as putting a new technology or a new idea into social or eco-

conomic use. An invention, the simplistic definition, is a creation of a new product merely becomes an innovation when it brings improvement on how things are done, is economically viable to adopt and brings a substantial impact in its areas of application (Woodhill, 2011). Scientific research and technology development are often confused with innovation. However, before a new cropping system, a new variety, a new technology or a new idea about microfinance for tracking products can be seen as innovation, it has to be efficiently and effectively adopted. As such, innovation requires not only introduction or creation of a new technology or idea but also creating suitable conditions so that it can be efficiently and effectively used and adopted. Moreover, an innovation is a new method of doing things for a particular organization, business or group. The fact the idea is already known by other people does not stop it from being an innovation for the group or organization adopting. Innovation becomes effectively adopted in a system. Sumberg (2005) describes a system as a set of interconnected components functioning toward a shared objective. In this view systems- including innovation systems- are made up of components (the operating parts of the system), relationships (the links between components) and attributes (the properties of the components and the relationships between them). Greater interaction between components makes a system more dynamic, flexible and able to generate and respond to change.

The concept distinguishes that innovations arise from systems of actors. These systems are surrounded by an institutional context which governs how individual actors act and how they interact with other elements of the system. Learning and the role of institutions are critical components of such systems. Learning is an interactive and socially embedded process that cannot be understood without reference to its culture and institutional context. Successful system are characterised by continuous evolutionary cycles of learning and innovation; combinations of institutional and technical innovations; interaction of various non-research and research actors; an institutional context that supports learning, interactions and knowledge flows between actors; shifting roles of information producers, users and transfers of knowledge dependent on a need bases. The innovation systems framework is a learning framework (Hall et al., 2003). An innovation system is conceptualized as a network of organizations concentrated on bringing new processes, new products and new methods of organization into economic use together with the institutions and policies that affect their performance and behaviour (Hall et al., 2006). This concept shows that innovation systems emphasis on innovation rather than production; focuses on interaction and learning; gives due attention for linkage for accessing learning and

knowledge; involves new actors and new roles; practices and attitudes govern the propensity to innovate; interaction of innovation and behavioural patterns; the value of policies; inclusion of the demand side and stakeholders; learning and capacity building; changing to cope up with change; and coping up with sticky information.

The use of agricultural innovation in food security

Strengthened research systems increase the supply of new knowledge and technology but they do not necessarily improve the capacity for innovation throughout the agricultural sector. Now -a- days, due attention is given to the ultimatum for research and technology and to improvement of broader linkages, competencies, enabling attitudes, governance, polices and structures that let this knowledge to be placed into productive use. The notion of an innovation system has leaded this more holistic approach to knowledge production and use. An innovation system is defined as comprising individuals, enterprises and organizations that together supply and demand technology and knowledge, and the rules and mechanisms by which these various actors interact. The innovation system notion emphasises not only on the science suppliers but also on the interaction and totality of actors engaged in the innovation. It goes beyond the construction of knowledge to include the factors limiting demand for and use of existing and new knowledge in useful and novel ways. Therefore, innovation is seen in an economic and social sense and not purely as invention and discovery (Hall et al. 2006).

Innovation system is a nice approach to bring food security. It views innovation as a collective process that is path reliant but open to change. This method emerged from historical investigation of national systems of innovation that created quick industrialization in South Korea and Japan. The crucial features of this method are the decentralization of formal research in support of a more universal framework that includes a wide range of institutions, policies and actors on the supply as well as the demand side. The use of this tactic to agricultural innovation has been comparatively recent, however, due to the domination of orthodox neo-classical notions of linear diffusion models and induced innovation. Innovation rises from the actions of and interactions between actors, so the borders of innovation systems are not given but develop over time. They can be characterized in terms inclusiveness (who is out and who is in) and the density of knowledge flows and interactions (between actors in the system and with those outside the system). Innovation systems are critically important in building food security especially in developing countries. The basic characteristic of innovation systems in food security is that it focus-

es on the 'multi-functionality' of agriculture; facilitates access to diversity; builds capability from the bottom up; and sustains continuity of attention and effort in agricultural development (Brooks and Loevinsohn, 2011).

Historical background in thinking on systems approaches

Different approaches to agricultural innovation have been developed over the past 45 years. The most well-known examples are induced innovation, transfer of technology approach, participatory research and technology development, farmer first, training and visit system, agricultural knowledge and information systems and agricultural innovation systems. Even though, AKIS and AIS have resemblance in definition, AIS was developed from a research perspective while AKIS was developed from extension perspective. The basic difference between them is that AIS focus on the influence of institutions (organizations like public research institutes, companies, and governmental entities) and infrastructures on learning and innovation, and its explicit focus to include all relevant organizations besides agricultural research and extension systems. To enhance networking for innovation, a number of factors are critically important. These include well-established linkages and information flows amongst the various actors, shared visions, conducive incentives that enhance adequate market, cooperation, policy environment and legislatives and well developed human capital. A good functioning AIS is characterised by learning within and between organizations to innovate, network based knowledge dissemination, strengthening individual and collective capabilities to innovate, and innovation agents focusing on dynamic and complex interactions. However, frequently innovation systems do not act as systems and display failures that hinder learning and innovation. Creating and fostering effective linkages amongst the heterogeneous actors is hindered by social, technological, institutional, culture and economic divides. This divide is caused by differences between scientific knowledge systems and local indigenous knowledge systems, different incentive systems for different actors, cultural and social differences that cause exclusion of certain actors and ideological differences (Klerkx et al., 2012).

The use of research in agricultural innovation system

The relationship between farmers and researchers is changing since the linear process is ineffective and these change created agricultural innovation approach. The conventional institutional view to researchers has been looking as a source of new agri-

cultural knowledge and transferring the knowledge to farmers separately through extensions. This centralized model separate researchers from farmers which limit the productive collaboration of researchers and farmers. Because of this linear problem, agricultural innovations come from different actors including research staff and farmers to have impact on making research relevant to farmers need by involving them in knowledge and technology production, diffusion and utilization. Effective linkage of researchers and farmers solved the problem of farmers in many countries like Indian farmers from post-harvest loss. Direct and effective linkage of researchers with farmers brings practical solution as farmers are involved in the actual innovation process of knowledge and technology development. From innovation systems perspective, innovation emerges from systems of actors. These systems are rooted in an institutional setting that affects how individual actors behave and interact with each other. Learning is the critical part of the system which comes from the interaction of researchers and farmers involved in knowledge production and use. Collaborative relationships are important in innovation since the benefits in innovative performance derived from productive relationships between researchers and farmers in the use of new knowledge in economic production (Klerkx and Leeuwis 2009; Hall, Bockett et al. 2001; Hall, Rasheed Sulaiman et al. 2003).

AIS in Africa lacks proper linkage among the different interrelated parts in the system to bring food security. Researchers have ineffective linkage for proper collaboration with farmers to exchange knowledge and to increase learning and innovation. The gap between researchers and farmers is wide and resulted in food insecurity. Agriculture is the motor of economic growth and research is the fuel for generating knowledge and technology to alleviate poverty in developing countries. However, agricultural research is weak and ineffective and has brought little benefits for the poor people who are living in the marginalized rural areas. Research in these countries is characterized by weak link with farmers, irrelevant to farmers need, poor incentives, high level of fragmentation, low level of professional training, high staff turnover, lack of financial independence and poor coordination among the different actors engaged in the sector resulting in low productivity, increasing levels of poverty and declining per capita food production. Agricultural research in Africa has yielded few benefits for the poor farmers since it has been focused on better endowed areas as opposed to the marginal areas where poor farmers are living; elitist and out-of-touch with rural realities; too often interested in productivity to the detriment of sustainability; discipline or commodity as opposed to system or livelihood-oriented; top-down or

supply driven, not participatory or demand-driven and reductionist as opposed to holistic approach. These show that research has been run itself a ground on the Green Revolution model of technology development and transfer. The impact of agricultural research is limited since the findings are not relevant to farmers need and are not often used by them (Sumberg 2005). As one of the developing country in the world, Ethiopia has similar problems in agricultural research. Researchers have weak link and ineffective collaboration with farmers and the findings of the research is not often used by farmers since the findings are irrelevant to farmers need. The reason why researchers do not conduct research which is relevant to farmers need through effective linkage and collaboration to bring research impact in the development of the country is not clear. There is no strong partnership between researchers and farmers which is important to bring food security.

Through time, key changes have taken place in the relations between end-users knowledge and the agricultural infrastructure. In the setting of agriculture, knowledge infrastructure indicates the whole of research, education and extension establishments. These relationships have changed because of the weaknesses of former innovation support systems (which is based on linear and science push models of innovation), that have led to the development of network and systems approaches to agricultural innovation such as agricultural innovation systems approach. From AIS perspective, the agricultural knowledge infrastructure forms portion of such an agricultural innovation system, but are not essentially the basic drivers. The innovation system embraces not only the science suppliers but the totality and interactions of actors involved in innovation (Klerkx and Leeuwis, 2009).

The significance of partnership between farmers and researchers

Effective link between researchers and farmers is critical for creating knowledge relevant to farmers and produced when researchers have effective linkage and collaboration with farmers. Effective linkage of researchers with farmers for collaboration results in utilization and acceptance of knowledge which is intended for farmers (Sumberg, 2005). From AIS outlook, farmers are important in making contribution in terms of articulating knowledge demands and adding knowledge to the innovation process. AIS helps to investigate the interface between researchers and farmers (Klerkx and Leeuwis, 2009). Partnership as a collaborative relationship between researchers and farmers in decentralized manner is highly important to create innovation and learning. But hierarchical institutional arrangements centralized agricultural research systems which created difficulties

to deal with the needs of farmers at the grassroots levels. The institutional view of research is the arrangements of different actors at different levels which either include or exclude and determine the role of these actors. This hierarchy created problems in addressing the need of farmers who are marginalized from contributing their share in the innovation processes since agricultural innovation is not produced by organized science alone unless farmers are involved (Hall, Bockett et al. 2001; Hall, Rasheed Sulaiman et al., 2003).

Factors hindering farmers' participation in research

1950s and 1960s was believed that the development situations particularly the economic development of developing nations could improve only through the development and transfer of modern technologies. The conventional top-down research system tried to address the crucial research problems encountered by farmers. Nevertheless, these approaches have given little consideration to the participation of farmers in technology development. Therefore, there has been minimum adoption of technologies by the end-users since the technology development process failed to consider the agro-ecological, socio-economic, culture and educational level of the end users in the country. In the 1970s, it was clear that the transfer of technology model failed to solve the problems of farmers in developing nations because of the relationship among environment, culture, economy and politics in rural societies of different nations. Subsequently the system as a whole had to be revised to bring the desired changes in the lives of farmers. Many evidences show that agricultural research can be most effective and productive in changing the lives of resources poor farmers when both researchers and farmers actively engage in technology development, evaluation and dissemination processes (Aberra and Fasil, 2005).

Collaboration of researchers and farmers to bring development can be affected by a number of factors. Collaboration is related to participation of farmers in research process. Farmers' participation in research process can affect collaboration of researchers and farmers positively or negatively. According to Neef and Neubert (2011), farmers' participation in agricultural research can be affected by various factors which are interrelated to each other. The authors from their many years' research experiences on participatory research identified six dimensions of participation which affects collaboration and partnership of researchers and farmers. These dimensions of participation which affect collaboration through participation are researchers' characteristics, farmers' characteristics, researchers' and farmers' interaction, type of research pro-

ject, research approach, and researchers' and farmers' benefit.

Research Methodology

Contemporary researchers in social sciences have started to put more attention on the use of qualitative research methods, i.e., methods by means of which one can study non-quantitative characteristics of empirical phenomena (like categories, meanings, assumptions and understanding underlying peoples' languages and practices). Data were generated primarily from knowledge institutes (Wal-laga University and Ambo Plant Protection Research Centre), Development agents and Farmers from Western Oromia through in-depth interviews. A total sample size of 79 respondents comprising 29 farmers, 27 researchers and 23 development agents were interviewed purposively based on snowball sampling technique.

A qualitative research design was used in this research. Triangulation between different data sources took place to ensure validity (Yin, 2003). Respondents were identified through snowball sampling and in-depth interviews were held. Interviews were fully transcribed, translated and coded applying principles of grounded theory (Glaser and Strauss, 1967) before it was descriptively analysed. Translation follows transcription of data before analysis. Facilitating a qualitative research interview is a hard work and difficult to write down responses while maintaining eye contact, providing encouragement and planning the prompt, probe or link to the next topic of interest, listening and other activities. Therefore, the interview was recorded on memory recorder. Key informants were mostly used as a means of gaining access to the interviewee. Focus group discussions (FGD) were used in this research since it has the advantage over one-to-one interviews of providing access to interaction among the participants and give some insight in how knowledge and innovation was produced. It was also used to augment the individual interview. Moreover, FGD can be a critical way of researching some sensitive matters such as dissatisfaction of farmers with researchers. Also observation was taken place in the role of observer-as-participant (Angrosino, M, 2007), in which the research relates to and was known to the subjects under study as a researcher. Observation was performed during annual prioritization meeting, research reviews, and field demonstrations. Existing documents were used as sources of data for this research since it can be efficient sources for qualitative questions.

In qualitative research the sample size for the interview depends on the aim of the research. Most qualitative research has the aim of purposive sampling which is explicitly selecting interviewees who it is intended will generate appropriate data. The overall aim of purposive as opposed to probability

sampling is to contain information rich cases for in-depth study. To achieve this different sampling techniques are used. These include typical case sampling, extreme or deviant case sampling and snowball sampling. In this research respondents were identified through snowball sampling technique. The best methodological answer to sample size in qualitative research is a grounded theory approach. The grounded theory approach is a qualitative research method that uses a systematic set of analytical, interpretative, and coding procedures, to develop an inductively derived grounded theory about a phenomenon. Grounded theory emerged in reaction to the formerly common practice of considering research only as a means of testing hypotheses. That means that the research started with theory that was subsequently tested. Grounded theory was developed as a systematic approach to develop theory on the basis of empirical research. The theory is then the 'finding' of the research. Grounded theory approach advocates theoretical sampling or including interviewees (the incidents and events that interviewees and other sources do provide) in the sample on the bases of both an emerging hypothesis from on-going data analysis, an understanding of the field and a delicate attempt to test such hypotheses. The objective is to keep sampling and analysing data until nothing new is being generated. This point is called saturation and the techniques are called sampling to saturation. When sufficient data are gathered it reaches theoretical saturation. In qualitative research 'statistical significance' of relations between the empirical phenomena which are being described is not a major criterion (Glaser and Strauss, 1967). A better criterion is what has been called sociological significance. This shows that the researchers' interest is to examine whether the descriptions of these conceived relationships are understandable, meaningful and convincing for the people involved and for the outside world (Elias and Scotson, 1976). In general, a systematic approach to qualitative data analysis is the use of the grounded theory. The procedure in grounded theory lies in a cyclical process of data collecting, analysing it, developing a provisional coding scheme, using this to suggest further sampling, more analysis, checking out emerging theory and so on until a point of saturation is reached, when no new constructs are emerging. At this point rich, dense theoretical account is achieved (Green and Thorogood, 2009).

Results and Discussion

The research findings revealed that the linkage of farmers with researchers in agricultural research was hindered by a number of factors. These linkage inhibiting factors hammered active participation of both farmers and researcher in research to bring social learning and innovation. These critical fac-

tors that held up linkage are listed and discussed as follows.

Irrelevant research type and fragile demonstration of technology

The research findings revealed that most of the research conducted in the study areas had little relevance to the needs of farmers. One of the causes for this irrelevant type of research was due to lack of farmers' participation in the research process. Moreover, the research had little room for farmers' engagement in the research because of the nature of the research type. This view was widely shared among researchers, development agents and farmers in the study areas. Most of the researchers used the traditional approach to identify research problems from other researchers' recommendations or literatures. This type of problem identification limited farmers' participation in research since the problems identified were not mostly relevant to the need of the beneficiaries to bring innovation in agriculture to assure food security. Moreover, most of the research was basic type which limited farmers' engagement in the research. These problems hindered the linkage of researchers with farmers in the study areas. After the development of agricultural technologies, farmers were informed and even sometimes forced to implement the technologies without having the necessary knowledge and skills. Farmers were not equipped with the basic skills because of lack of proper demonstration of technologies either by researchers or development agents. Since researchers were technology developers, they did not have the obligation and time to show their technologies to the beneficiaries. The work of technology demonstration was left to extension workers. However, they did not have sufficient knowledge, skills and time to demonstrate technologies to farmers properly as they had many assignments from the government besides limitation of their academic background. These were some of the factors that hindered the linkage of researchers with farmers and inhibited innovation in agriculture to bring food self-sufficiency. This finding shows similar result with the work of (Belay, 2008; Spielman, Davis et al. 2011; Abate, Shiferaw et al., 2011; Neef and Nubert, 2011) that research type critically affects the linkage of researchers with farmers. Basic type of research does not have a room for farmers participation in agricultural research. This affects the interaction of farmers with researchers and critically reduce innovation in agriculture. Moreover, lack of strong innovation in agriculture hinders assuring food security in the country.

Farmers' experience and their expectation from the research

The research showed that farmers' previous experiences critically affected the linkage of researchers with farmers. Some of the farmers who were involved in the research before many years told that they did not have good experiences from the research. These farmers who told their experiences lost their resources instead of getting profits from agricultural technologies. One of the farmer respondents shared his view regarding his experiences in agricultural research as follows:

"I was using agricultural technologies developed in research before many years. Extension workers came to me to tell about the availability of new agricultural technologies like selected seeds and animal breeds for implementation. They told me several times that these selected seeds and animal breeds give good return at the end of the cropping and breeding seasons. Once upon a time I decided to use the modern technologies to improve my live. I sold my oxen to buy the new technologies. I used maize hybrid and it was failed. I got no harvest in that year. I was suffered since I used most of my land for the maize hybrid and I could not get sufficient harvest to feed my family. The crop was failed because of lack of rain and disease incidence in that year. The research was promised to give me money if it fails but I did not get anything after the failure of the crop. The researcher did not keep his words and they break it. After that encounter I am not using these new technologies especially when it comes first. This is my bad experiences in working with researchers."

Moreover, farmers' expectation affected the linkage of researchers with farmers. Farmers expected material benefits from both research and researchers. Farmers expected things like money, sugar and coffee when they gave information to farmers for their research. They also expected enough money for their labour and land when they were engaged in the research. However, things were not as they expected and created gap between them and researchers. According to the works of (Abera and Fasil, 2005; Belay, 2008; Neef and Neubert, 2011; Bayissa and Mansingh, 2015) the linkage of researchers with farmers is affected by farmers' bad experiences in the past and their expectation from the research and researchers. Farmers having bad experiences from agricultural research do not have the interest to engage themselves again in the research. Farmers also expect a lot of benefits from the research and lack of it results in loose linkage with researchers.

Limited integration of indigenous and scientific knowledge

The research showed that there was little integration of indigenous knowledge with scientific knowledge among researchers conducting their research in agriculture. Farmers were using their

indigenous knowledge for a long time of period. Moreover, they used their knowledge to solve their own problems in agriculture. Furthermore, it was the only asset that they had inherited from their ancestors. Additionally, it was the knowledge that they knew best since they had experienced about the success and failure of the knowledge in practice. However, researchers mostly use the scientific knowledge that they acquired from universities. Most of the researchers thought that it was only the scientific knowledge that solved the problems of farmers. This problem of integrating the scientific knowledge with the local knowledge created gap between farmers and researchers to conduct demand-driven research. Furthermore, it hindered active engagement of farmers in agricultural research to bring innovation in agriculture. This problem of little integration of scientific knowledge with indigenous knowledge hindered the linkage of farmers with researchers to work together for the development of agriculture to bring food security. This research work shows similarity with the findings of (Neef, 2005; Asten et al., 2009; Klerkx et al., 2012) in that the level of integrating the indigenous knowledge with scientific knowledge critically affects the linkage of researchers with farmers to conduct demand-driven research to bring innovation in agriculture. Farmers are adhered to their local knowledge since they know its effect from their experience. Agricultural researchers give due attention to the use of scientific knowledge and they think that it is only the knowledge that solve the problems of farmers.

Farmers' attitude for research and researchers

The study indicated that the perception that researchers had for research was different from farmers' perception for research. Farmers were using the traditional method of rearing animals and farming that they obtained from their family. For farmers, research work was the western method of working in agriculture. Moreover, research was conducted by someone who was educated in universities. Research was complex and difficult for them. Farmers had thought that their contribution in research was little in technology development since they thought that they were illiterate. One of the farmer respondents shared his view about the perception he had for research as follows:

"I have been using the traditional way of farming which I learnt from my father's in the past. I did not go to school. I am a layman. I do not know anything about the modern science which is obtained from schools. My father was a farmer and did not go to school too. Participating in research is difficult for me since I do not know and understand what researchers are saying. Research is a complex process beyond my knowledge and capacity. The educated people can do it without problems.

Researchers say you have to weed many times which is two or three times the traditional weeding practices. They say you have to sow crops in rows which are difficult for some seeds to sow in rows. Working in research is a challenging work since researchers themselves even say do this and that which is irritating."

Moreover, farmers' relationship with researchers was hindered by the mentality that they had for researchers. Farmers perceived researchers as someone who talked things in theory without showing things in practice. For farmers, researchers were white-collars who did not want to touch soil. Farmers looked researchers as highly educated people and saw them as boss and fear to work with them. These all problems hindered the linkage of researchers with farmers to bring innovation in agriculture to assure food security in the country. Many empirical evidences (Wigboldus, Seerp, et al., 2011; Neef and Neubert, 2011; Bayissa and Mansingh, 2015) show that linkage of researchers with farmers is critically affected by the perception that farmers have for research and researchers. Farmers having good attitude for research and researchers can have strong linkage with researchers. This helps to bring innovation in agriculture by sharing the knowledge of different actors that are engaged in agricultural development to bring food security for the poor and marginalized farmers.

Limitation of priority setting and choosing productive areas

The research conducted showed that there was limitation in terms of prioritizing the type of research to be conducted to solve the problems of farmers. Since the country is very wide and have different agro-ecological zones that demanded different types of prioritization to bring solution for these problems. Most of the researchers conducted their research in a specific context and gave recommendations to the entire areas. Moreover, there were problems in prioritizing farmers' problems. Most of the time what researchers prioritized as first was not the actual problems of farmers. This was because of limited participation of farmers in the research starting from problem identification. Furthermore, what the government prioritize as first was not the one that attracted the attention of researchers. Mostly researchers prioritized research that matched their interest and experiences. Even when they conducted research that was prioritized as the need of farmers and government, they selected potential areas that gave good results for their research. Researchers selected potential areas for the fear of failure. This limited the linkage of researchers with farmers in agricultural research in the country. The work of (Hall et al., 2006; Brooks and Loevinsohn, 2011; Woodhill, 2011) show that research priority setting critically affects the link-

age of farmers with researchers. Farmers participate in agricultural research if it solves their agricultural problems. Moreover, selecting potential areas for research affects farmers' engagement in agricultural research. These problems limit innovation in agriculture to bring food security for the needy people.

Knowledge & skill limitation to conduct demand-driven research

The research result revealed that there was limitation of knowledge and skills to conduct demand-driven research. Employing people both in agricultural research and universities depended only on their result that they obtained during their stay in the university. This cumulative grade point average (CGPA) did not necessarily show the potential of the employee in knowledge institutes to conduct demand-driven research. People who graduated from universities might have good knowledge in reading and understanding theories from books and lectures. However, they might be poor in having the knowledge and skills to conduct demand-driven research in the rural areas to bring rural innovation. Moreover, most of the people who were employed in knowledge institutes were originally from urban areas. These people did not know the experiences of the rural people and most of them did not want to go to the rural areas since they did not get the necessary social services in the rural areas. Furthermore, these researchers who did not have exposure to the rural areas did not have good attitude for the rural people in terms of their knowledge and their way of life. Most of the senior researchers interviewed during the research told that the problems of knowledge and skills limitation on the parts of researchers were related to the educational system of the country. They told that students, during their stay in the university, did not get sufficient practical skills that enable them to be employed as researchers while the students were in the university. These problems emanated from different sources like limitation of budget for the university to engage students in field works during their study in the university. Likewise, the curriculum did not make most of the students ready to get practical skills from farmers and researchers. This limitation in terms of knowledge and skills hindered researchers to engage farmers in research and critically limited the linkage of farmers with researchers. The work of (Aberra and Fasil, 2005; Sumberg, 2005; Belay, 2008; Woodhill, 2011; Bayissa and Mansingh, 2015) reveal that researchers' knowledge and skills greatly affect the type and nature of research to be conducted to bring innovation in agriculture. Knowledge and skills create confidence in researchers to conduct demand-driven research to alleviate farmers' problems. Knowledge and skills of researchers' is related to

their academic and social background. Moreover, the curriculum of universities fundamentally affects the potential of researchers during their stay in the academic environment. These problems affect the linkage of researchers with farmers to conduct demand-driven research to bring innovation in agriculture.

Scientists' perception for farmers and their knowledge

The study indicated that scientists' attitude for farmers was not encouraging to bring national food security through the integration of the different stakeholders in agricultural research. Scientists perceived farmers' as people who were not educated and the one who could not solve their own problems. Researchers thought that farmers were passive and needed solutions for their agricultural problems from agricultural scientists. Moreover, most of the researchers thought that farmers did not have the necessary skills and knowledge to solve their own agricultural problems. Most of the interviewed farmers told that most of the researchers did not have the interest to hear ideas from farmers. The people interviewed indicated that for researchers hearing to farmers' views was waste of time and resources. This mentality from researchers showed that farmers did not have the necessary knowledge and skills to be partners with researchers to be engaged in agricultural research to bring innovation that can be obtained from the interaction of different actors working in agricultural development. This research reveals similar result with the works of (Neef, 2005; Asten et al., 2009; Neef and Neubert, 2011; Klerkx et al., 2012) that researchers' attitude radically affects the perception that they have for farmers and their knowledge. Researchers perceive farmers as illiterate and their knowledge as something having no or little value in solving agricultural problems to bring innovation in agriculture. This type of researchers' perception for farmers and their knowledge greatly affect their linkage with farmers.

Experience and Attitude of Scientists 'about Participation

The research showed that researchers had limited experiences of working with farmers in agricultural research. Most of the research plans were not participatory to engage farmers in agricultural research to bring innovation. Most of the agricultural researchers had limited interest to engage farmers in agricultural research to bring mutual learning. One of my respondents described about his observation about researcher's interest to engage farmers in the research process as follows:

"Researchers do not show interest to engage and work with farmers in their research process.

Since farmers are not engaged in the whole research process, there is no chance for farmers to learn and develop skills and knowledge on how to solve their problems in the future in sustainable way. Farmers do not develop sense of belongingness and strong relationship with researchers since they are not part of the research process. For researchers, involving farmers in the research is wastage of time and creating complexity to elongate the path way of the research process to develop agricultural technologies.''

Researchers' had limited interest to engage and work with farmers in agricultural research emanated from different reasons. Most of the researchers' perception about the skills and knowledge of farmers was limited. For researchers, farmers' skills and knowledge contribution in agricultural research was narrow and insignificant in agricultural technology development. Moreover, even if farmers were engaged in agricultural research, their capacity to learn from the research was inadequate and they did not use the skills and knowledge acquired from the agricultural research to improve their life in the future. Furthermore, research was complex for farmers to involve them. These factors hindered the linkage of farmers with researchers in research and affected innovation. According to the works of (Belay, 2008; Woodhill et al., 2011; Neef and Neubert, 2011; Bayissa and Mansingh, 2015) the linkage of researchers with farmers is crucially affected by the perception that they have for participation. Researchers' experiences in participation are a factor affecting them to engage stakeholders in agricultural development. Researchers who have good experiences in participation do have wide room to involve farmers in research to bring innovation in agriculture.

Weakness of top- down research designing

The research finding revealed that most of the research plans and objectives were designed in the top-down approach. Even some of the research plans came from other countries that were developed under different situation and agricultural research organizations were told to implement the research. Most of the time politicians had brought the initiative to conduct research that was conducted in other countries to bring development within short period of time to bring food security. In fact, politicians had great ambition to bring development to make the marginalized and poor farmers beneficiaries of the technology. However, researchers had little interest in the research topic; they did not put their effort to develop the technologies for the welfare of the society. Lack of interest hindered researchers and extension workers to exert their maximum energies for the success of the research. This issue created the problems of involving farmers in the research to bring innovation in agriculture.

According to the works of (Klerkx and Leeuwis 2009; Spielman, Davis et al. 2011; Abate, Shiferaw et al., 2011; Wigboldus et al., 2011) top-down research planning approach inhibits the involvement of stakeholders in the research and reduce their motivation. Little engagement of stakeholders in the research planning reduces researchers' enthusiasm to participate farmers in the research to conduct demand-driven research to bring food security in the country.

Communication problems and the willingness to learn

The study result revealed that there were problems of language among the different actors engaged in the research. Most of the researchers used English for writing research proposals and results of the findings. Moreover, most of the technologies were written in English and created difficulty in understanding the content of the information for the beneficiaries of the technology. However, farmers had used the local language for their daily interaction. This difference in language created problems between researchers and farmers to understand each other and use the information for productive purposes. Moreover, there was limited readiness and willingness between farmers and researchers to learn from each other to bring change in the country. This problem was critical among researchers. Most of the senior researchers did not have the interest to share their experiences to the junior ones. Furthermore, there were great problems among the junior ones to learn from the senior researchers. One of my respondents during my research shared his view concerning the differences in world views concerning senior and junior researchers as follows:

“There is a big problem among the educated people to learn from each other. There is a big complexity among the senior and junior researchers. Senior researchers do not have the interest and willingness to hear from junior researchers. Senior researchers think that senior researchers have to be respected both for their age and academic status. But junior researchers think that seniority is a matter of age. Someone can hold a PhD over time and no need to give due attention of age and academic status. For junior researchers seniority should be seen from the angle of research results' achievement which is relevant to the beneficiaries need. Junior researchers argue that there are little or no experiences that are learned from senior researchers. senior researchers need to lead junior researchers as a boss because of their seniority but junior researchers complain that to be a leader, appointment should be merit based and a leader should be someone who has a willingness and readiness to learn from his colleagues. But senior researchers are not ready to learn from others and

as a result junior researchers do not have the readiness to learn from senior researchers.”

The above quotes are the commonly shared view among most of the researchers interviewed during the research period in the study areas. This problem was created due to limited understanding of the common goal to bring innovation in agriculture that enables the country to assure food security. This created big gap between researchers and farmers and resulted in weak linkage among the stakeholders engaged in agricultural development. Different evidences (Klerkx and Leeuwis 2009; Brooks and Loevinsohn, 2011; Neef and Neubert, 2011) show that linkage is hindered by the language and interest that the different actors use in the research. Readiness and willingness is basically important for the formation of partnership among the different stakeholders working in agricultural development. Lack of common language and interest highly hammers the interaction of researchers with farmers and hence affects innovation in agriculture.

Conclusions

From the research findings the following conclusions were given. The linkage of researchers with farmers was weak emanating from a number of factors. Most of the research was basic type and has little room for engaging farmers in the research for mutual learning to bring innovation in agriculture. Farmers had bad experiences in the past from agricultural research that affected their relationship with researchers. The integration of indigenous knowledge with scientific knowledge was very weak. Moreover, farmers perceived research as a complex and difficult process to work with researchers. Researchers also perceived that farmers' involvement in agricultural research had little contribution for the generation of technology as farmers were illiterate and their knowledge is insignificant.

The study indicated that there were problems of priority setting during research planning to alleviate farmers' problems. Moreover, researchers selected potential areas that would give better results for their research. There were limitations of knowledge and skills to conduct research that was relevant to the needs of farmers emanating from inadequate student's exposure to the actual field condition while they were in universities. The research findings showed that some of the researchers did not have sufficient experiences of working with farmers and other stakeholders to bring national food security. Furthermore, most of the researchers did not have good attitude about the philosophy of participating farmers in agricultural research. Top-down research planning approach greatly hindered farmer's involvement in agricultural research. Likewise, limited forum for experi-

ence sharing among researchers was seen as a great problem besides limited interest among stakeholders to learn from one another to bring innovation in agriculture to enable the country to assure national food security especially for the poor and marginalized farmers.

Recommendations

Strong linkage of researchers with farmers is one of necessary factors for stakeholder's resilient interaction in agricultural research. Strong linkage produces strong interactions which bring innovation in agriculture. Therefore, from the research findings the following recommendations are given to bring agricultural development in the country. For the existence of strong linkage between researchers and farmers, researchers should consider the following points. Researchers should conduct applied type of research that has a room for farmer's engagement to bring mutual learning among them. There should be strong integration of the indigenous farmer's knowledge with the scientific researcher's knowledge to generate technologies that is relevant to farmers demand. Moreover, researchers have to consider farmers as development partners than looking them as illiterate and objects that have no role in the development of the country. Furthermore, the educational system of the country has to be strong and responsive to the need of the society. Students should get sufficient exposure to the real rural conditions and enough practical training during their stay in the university before they are employed as researchers. Knowledge institutes would better employ people who have sufficient field experiences than fresh graduates. There has to be forum for sharing experiences among researchers and other stakeholders for mutual learning to bring innovation in agriculture to bring agricultural development.

Implications

The findings of this research have the following implication for agricultural development in the country. Strong linkage between farmers and researchers brings innovation in agriculture. Conducting applied type of research creates rooms for farmer's involvement in agricultural research. Integration of the different knowledge sources is critically important to efficiently utilize the scarce resources that the county do have and realizes the importance of farmers as research partners in agricultural development. Strengthening the educational system is fundamental to produce graduates that conduct demand-driven research to alleviate farmer's problems to make the county one of the middle income countries as planned by the government by 2025.

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Notes

1. The world linkage is operationalized in this study as a range of partnership, collaborations, coordination, integration, participation, interaction, learning and exchange of useful information among the different actors such as knowledge institutes (research centres, universities and training centres), farmers and industries for technical and institutional innovation.
2. The term 'knowledge institutes' refers to formal, not-for-profit groups that provide products and services in the field of knowledge generation, dissemination and exchange. They include universities, research groups and training institutions.

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