



Investigating Farmers' Characteristics Affecting Their Linkage with Researchers in Agricultural Innovation in Ethiopia

Debella Deressa Bayissa^{1*} and J. Paul Mansingh^{1*}

¹Department of Rural Development and Agricultural Extension, Institute of Cooperatives and Development Studies, Ambo University, P.O. Box-19, Ambo, Ethiopia.

Authors' contributions

This study was carried out in collaboration between both authors. Author DDB designed the study, the methodology and wrote the first draft of the manuscript. Author JPM affirmed the methodology and corrected the first draft of the manuscript. Author DDB did the data analysis and wrote the final draft of the manuscript. Author JPM corrected and certified the final draft of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Ethiopia is the second most populated country having more than 90 million people in Africa. Ethiopian economy largely depends on agriculture. Agriculture accounts for 90% of exports and 85% of employment while 90% of the people depend on agriculture for their livelihood. Low agricultural productivity is the major problem for food insecurity emanating from the use of traditional farming practices, lack of appropriate technologies, low adoption of agricultural innovations, and lack of strong linkage between researchers and farmers. The linkage between farmers and researchers is affected by experiences of farmers with previous research projects, farmers' perception for researchers, the degree of farmers' involvement in research projects and

*Corresponding authors: E-mail: dabalaataf@gmail.com, paul461967@gmail.com;

farmers' characteristics. Therefore, the objective of this study was to identify key factors related to farmers' characteristics hindering the linkage of farmers with researchers in agricultural innovation in Ethiopia using the agricultural innovation system (AIS) framework. A qualitative research design was used. The research revealed that attitude of farmers for researchers, farmers' attitude for research, bad experiences of farmers in the past, lack of sufficient time and farmers' expectation were the farmers' characteristics affecting the linkage of farmers with researchers in agricultural research innovation.

Keywords: Researchers; farmers; linkage; Ethiopia; agricultural innovation.

1. INTRODUCTION

Ethiopia is the second most populated country having more than 90 million people in Africa next to Nigeria and the 13th populated country in the world. Ethiopian economy largely depends on agriculture. It accounts: 47% of the GDP of the country [1]. Moreover, agriculture accounts 90% of exports and 85% of employment while 90% of the people live on agriculture [2]. Development in the country can happen if there is yield increment both from crops and livestock in the sector of agriculture. The country has different agro-ecological zones which is conducive for the production of different types of crops and rearing of animals [3].

Low agricultural productivity is the major problem for food insecurity in Ethiopia. This problem emanated from the use of traditional farming practices, natural hazards like drought, lack of appropriate technologies for farmers, low adoption of agricultural innovations by farmers, poor access to market, and lack of strong and effective linkage between researchers and farmers. This has led to low agricultural productivity exposing the country to food insecurity [4]. Innovation in the agricultural sector is weak and slow in adoption, i.e., the use of inorganic fertilizer is limited to 37% of farmers, and application rate is 16% per hectare. Use of improved seed and agricultural technology is low. In spite of recent favourable rainfall and positive policy reforms, the production of agriculture is still low. Agricultural innovation is weak because of lack of effective linkage between researchers and farmers in the country [5].

The relationship between farmers and researchers is changing since the linear process is ineffective and these change created agricultural innovation approach. In this study, an Agricultural Innovation System (AIS) perspective is used to guide the research since linkage is an attribute of innovation system in agricultural research [6]. The conventional institutional view to researchers has been looking as a source of

new agricultural knowledge and transferring the knowledge to farmers separately through extension. 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 since farmers are involved in the actual innovation process of knowledge and technology development. From an innovation systems perspective, innovation emerges from systems of actors. These systems are rooted in an institutional setting that affects how individual actors (researchers and farmers) 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 [7,8,9].

Agricultural innovation system 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. The impact of agricultural research is limited since the findings are not relevant to farmers need and are not often used by them [10]. As one of the developing country in the world, Ethiopia has similar problems in agricultural research. Researchers have weak linkage 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 in the country. 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 [7].

Effective linkage 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 [10]. From AIS outlook, farmers are important in making contribution in terms of articulating knowledge demands and adding knowledge to the innovation process. AIS help to investigate the interface between researchers and farmers [9]. Partnership as a collaborative relationship between researchers and farmers in decentralized manner is highly important to create innovation and learning. But hierarchal 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 [7,8].

The interaction and collaboration of researchers and farmers are affected by a numbers of factors. These linkage limiting factors include incentives and attractive salaries for both farmers and researchers that enhance the collaboration of researchers with farmers, share vision in agricultural development, adequate market for farmers to sell their produce, the level of linkage established between farmers and researchers, legislatives and policy environment, information flows between researchers and farmers, political stability in the country, merit based employment and position appointment, hierarchal approach between the actors, well-developed capital, difference between farmers indigenouse knowledge and researchers formal scientific knowledge, social status, cultural differences which exclude farmers from working with the educated researchers, intellectual property rights, professional status that affect the relationship of the actors, political interferences and ideological difference among the actors in the country [11].

Participatory Technology Development (PTD) is one of the key arenas for social learning and helps stakeholders to contribute their share in the innovation system. Stakeholder participation in agricultural research should take into account the dynamic and complexity of agricultural research processes and diversity of stakeholder engagement in various research contexts. Stakeholders' participation in research has to be from the planning phase to the evaluation phase. Farmers' participation in agricultural research is affected by farmers' characteristics [12].

Farmers' characteristics are as equally important as researchers' characteristics to form effective collaboration and linkage with researchers to bring food security through conducting research relevant to farmers need. This dimension looks at the place of researchers in the eyes of farmers in the research process to alleviate agricultural problems in knowledge and technology creation, dissemination and use. In most cases farmers participate and form collaboration in research if certain conditions are met on the part of the research project, researchers and their methodological approach. Farmers' involvement in research projects depend on their own characteristics, the opportunity cost of time, and their own expectations from the research project. This is highly affected by social, economic, political and cultural environment. According to the works of Neef and Neburt [13], farmers' characteristics that affect the linkage of farmers

with researchers in agricultural research includes farmers experiences with previous research projects, availability of time for farmers' to work with researchers, farmers' perception for research, farmers' attitude for researchers, and farmers' scope of action.

Experiences of farmers' with previous research projects highly affect the linkage of farmers with researchers. In case the previous research project has failed to deliver results, farmers approach the new project with scepticism and reservation. Perception of farmers for the research project is another factor which hinders effective collaboration. Farmers engage themselves in research project if they think that they will get increased benefits from their cropping systems or rearing of animals and if they believe they can be impacted positively through the research process. Perception of farmers is highly important for effective linkage and collaboration. Farmers observe the characters of researchers, categorize the social position and use this categorization in their interaction with agricultural researchers. Farmers perceive researchers as teachers who want to instruct them as experts giving support, or as facilitators of mutual and continuous learning process. Farmers' perception has strong influence on the interaction with researchers in the research process. The way farmers perceive researchers' attitude is a critical factor for effective collaboration in research process. Availability of time for farmers is another factor which hinders collaboration since linkage needs a major commitment on the part of farmers in terms of labour and time. Most of the poor farmers in developing countries like Ethiopia are primarily concerned with meeting their basic needs for their family and may not have sufficient time to get involved in research projects. However, a few poor families have sufficient time to engage themselves in the research projects to use the technologies to meet the basic needs of their family. Farmers' scope of action is a limiting factor for effective collaboration. Farmers know they need to change some of the practice but unwilling. This indicates constraints that farmers are facing in changing land use system or soil conservation in high land areas. In some instances, farmers do not see any scope for changing the management systems of practices due to lack of access to credit or market, extreme poverty, unfavourable agro-ecological conditions or a repressive institutional environment. On the other hand, farmers collaborate with researchers since they enjoy the favourable agro-ecological

conditions, good economic resources, good access to rural finance and markets and a highly supportive institutional environment.

Therefore, the objective of this study was to investigate key factors hindering the linkage of farmers with researchers in agricultural innovation in Ethiopia. The research findings, hopes to inform recommendations to policy makers and public authorities to contribute to solve the problems which hinder effective collaboration of researchers with farmers with the aim to solve practical problems at grassroots levels.

2. RESEARCH METHODOLOGY

2.1 Sampling and Data Collection

Qualitative research method was used in this study. Data were collected from Wallaga University and Ambo Plant Protection Research Centre using in-depth interview. In qualitative research the sample size for the interview depends on the aim of the research. Most qualitative research uses purposive sampling which is explicitly selecting interviewees who it is intended will generate appropriate data. It is to contain information rich cases for in-depth study. Purposive sample sizes are often determined on the basis of theoretical saturation (the point in data collection when new data no longer bring additional insights to the research questions). Purposive sampling is therefore the most successful when data review and analysis are done in conjunction with data collection. Snowball sampling (known as chain referral sampling) is a type of purposive sampling in which informants with whom contact has already been made use their social networks to refer the researcher to the people who could potentially participate in or contribute to the study.

For the study, a total of 59 respondents were interviewed: 24 researchers from Wallaga University and Ambo Plant Protection Research Centre, 19 farmers, and 16 extension workers. 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. 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. Interviews were fully transcribed and coded applying principles of grounded theory [14,15]. Also, observation at meetings took place in the role of observer-as-participant [16], in which the researcher relates to and is known to the subjects under study as a researcher. Several documents such as meeting minutes, policy documents and internal evaluations were analysed. Triangulation between different data sources took place to ensure validity [17].

2.2 Theoretical Framework

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 ongoing 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. A better criterion is what has been called sociological significance [14,15].

3. RESULTS AND DISCUSSION

Farmers' characteristics highly affected the linkage of farmers with researchers in establishing strong partnership for effective

collaboration in Ethiopia. The limiting factors affecting farmers' participation in research that were related to farmers' characteristics are discussed and presented below as follows.

3.1 Attitude of Farmers for Researchers

Farmers do have agricultural experiences which they have inherited from their families. They have their own local knowledge to solve their problems. They evaluate everything in relation to practical applicability. One of my farmer respondents in one of the study areas described his attitude for researchers. He knew about farm works since his childhood. He attended his school up to grade 10 before 17 years. He has been working with researchers for many years since he has a land near the town which was fertile and suitable to give good yield. Mostly researchers have been using his land and he has been involved as daily labourer for the research. Since he has worked for many years with researchers, he has his own observation on researchers and described his attitude for researchers as follows:

"Researchers come to the site to visit what we are doing. When they come to the site they talk a number of things in theories. They do not need to touch soil. They do not like to eat and drink with us. They undermine our knowledge and they do not need to hear anything from us. They stay only for a few minutes and go to the cities and town for enjoyment. They are white-collars. They employ someone who shows us how to sow seeds, apply fertilizers and other activities. They do not show us anything in practice. They are theory people".

The above quote shows that this farmer perceived researchers as people who talk things in theory without demonstrating things in practice. Farmers evaluated researchers skill based on their long term experiences inherited from their fathers and grandfathers over centuries. For farmers, researchers were white collars who did not need to touch soil, teachers who talked mostly things in theory, and people who ignored farmers' knowledge and had less interest to hear farmers' ideas. Farmers looked down upon researchers as bosses and feared to work with them. Farmers perceived researchers as educated people and saw them as the one who were from the royal family and thought that these researchers did not touch soil. Researchers were not working with farmers in a

friendly manner. For farmers, researchers were working their own business and selling the results of their research which they collected from farmers. These attitudes created gap between farmers and researchers to establish proper linkage to bring national food security. This result showed similar finding with other researchers affirming that farmers' attitude as farmers' characteristics highly affects the linkage of farmers with researchers in agricultural research to create food security in the country. Most of the farmers do have negative attitude towards researchers [7,9,13].

3.2 Farmers' Attitude for Research

Farmers in the study areas were adapted to the traditional way of farming and rearing of animals which they have learnt from their ancestors. From farmers' point of view, research activities in agriculture were the western way of farm practice which farmers looked as a difficult work. Research was a special activity which was done by educated people from farmers understandings. One of my farmer respondents in one of the study area expressed his view for research as follows:

"I have been using the traditional way of farming which I learnt from my father 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 a research is a challenging work since researchers themselves even say do this and that which is irritating".

It is possible to understand from the above saying that research was a complex process that was difficult for farmers to work with researchers. From the farmer's explanation, one can learn that farmers looked at research as a complex process and thought that working in research was beyond their capacity since they did not attend university and did not have university degree as researchers. Farmers thought that they could not

contribute anything to research since they did not know about scientific knowledge and they did not have western mentality. Farmers perceived that to conduct research somebody should have university degree. This attitude was developed because of the working habit and culture of the educated people since the educated people were seen as solution providers to farmers in the study area. Farmers' attitude for research in the study area showed that the partnership of farmers with researchers was affected by the attitude of the different stakeholders who were involved in the research including farmers' attitude. This attitude on the parts of farmers was affected by their academic status. Different authors revealed that the linkage of farmers with researchers is affected by farmers' attitude that hindered strong collaboration of both stakeholders to bring food security through agricultural innovation [7,8,10,13].

3.3 Bad Experiences of Farmers in the Past

Farmers have had their own experiences in relation to research in the past. Farmers knew about new technologies produced in research before many years even though they have not used the agricultural technologies in a proper way because of the bad experiences they encountered before. One of my informant who was a rich farmer in the study area was involved in research and was using the agricultural technologies for many years described his experiences and encounters 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 life. I sold my oxen to buy the new technologies. I used maize hybrid and it failed. I got no harvest in that year. I 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 failed because of lack of rain and disease incidence in that year. The researcher 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”.

Farmers have experienced bad experiences in the past. Researchers went to farmers and gave false promises which they could not do. Technologies failed under farmers' field and they did not obtain what they expected from the technologies. Researchers told farmers that they could get more benefits from using the new technologies. Farmers sold what they have to buy the technologies. After buying the technology, it either failed or gave less result than the one which they used before. Inappropriate technologies were also given to farmers for adoption. These technologies which were not appropriate to the given agro-ecological zones failed and farmers concluded that new technologies were not working under their farm condition. This emanated from lack of considering the local problems before the introduction of the new technologies. Failures of technologies had risk on farmers life and they feared risk since there was no insurance for the failure of the technology. Because of the failure of technologies and fear of risk, farmers needed to adhere to the practice that they had used for many years. Farmers knew from their experiences the type of technologies which suited to their conditions. This created gap between researchers and farmers in establishing linkage. Bad experiences of farmers working with research projects and researchers are the common problem among many developing countries including Ethiopian farmers. Agricultural technologies need specific recommendation to specific agro-ecological zones for the success of the technologies. Lack of education from the farmers' side and lack of commitment from the different stakeholders contribute to the failure of agricultural technologies and thus this failure of technology under farmers' condition results in weak linkage of farmers with researchers [1,4].

3.4 Lack of Sufficient Time

Farmers in the study area engaged themselves in different activities. They spent their time on agricultural routine activities, social affairs and family matters. One of a socially active farmer told me about his time allocation for agricultural research during my interview in the field. From his views, he did not have sufficient time to engage himself in research activities since he

was engaged in different activities to support his family besides social affairs. He stated his views on time allocation for the different activities in his daily life as follows:

“I have eight family members. Three of my sons and two daughters are students. The rest of the family are children. I am engaged in different agricultural activities to support my family. It is me who is cultivating the land, weed crops, keep animals, harvest crops and other agricultural activities. I am also expected to involve in social affairs like idir, mahiber, izen etc. in the community. There are also different government meetings which I should attend when the government cadres call us for meeting. Funeral and wedding ceremonies are also the basic activity in the community which I must participate. Since I am poor, I am forced to engage myself in different agricultural and non-agricultural activities to support my family life. Because of these activities, I do not have sufficient time to engage myself in research.”

Since most of the farmers in the country are poor, they are engaged in different agricultural and non-agricultural activities to support their life. Ethiopian farmers are socially active and spend most of their time on social affair and daily routine activities. Because of these routine activities, farmers did not have sufficient time to engage themselves in research. This created gap between farmers and researchers to establish strong linkage. It is universally accepted that agricultural activities are time bounded for farmers. Once the time for cultivation of land is passed especially for rain-fed agriculture, it is highly dangerous for farmers who are living on it. Since most of the farmers in developing countries like Ethiopia are socially active and engage in many social affairs, they do not have sufficient time to engage themselves in agricultural activities. Lack of enough time to work with researchers in agricultural research limits farmers from being innovative in their agriculture to bring food self-sufficiency. Lack of the necessary knowledge and skills that can be obtained from the network of different actors that can be obtained when there is strong linkage can hinder effective collaboration between farmers and researchers' [1,6,7].

3.5 Farmers' Expectation

Farmers expected monetary aid from NGOs and government for agricultural technology subsidies

since they were unable to afford the cost of the technologies. Farmers also expected positive returns from the use of the technology. They did not need to see failure in their farm since they did not have other opportunities to support their life if they lost the on-season for their crop production and rearing of animals. Farmers also expected coffee, sugar, and other type of payments and incentives from researchers when they filled questionnaires. Non-fulfilment of the expectation creates gap between farmers and researchers to form linkage [13].

3.6 Weakness of the Linear Model (Research-Extension-Farmer)

From the institutions point of view, researchers were mostly engaged in technology development in the research process in the study areas. Dissemination of the technology was given to Ministry of Agriculture which gave the mandate to the extension wing of the ministry. It was the extension that was totally responsible for the dissemination of agricultural technologies. Researchers did not have direct contact (structure) with farmers in the study areas unless they got permission from the agricultural office. Farmers were told not to work with anyone including researchers unless they came through the government structures starting from the Woreda agricultural offices to the Kebele level. If researchers wanted to work with farmers, they had to get permission from the Woreda agricultural offices. Getting permission from these offices was not simple. People who were working at woreda agricultural offices were bureaucratic. It was also difficult to get the concerned bodies for getting permission. The existence of agricultural office (extension office) at different levels between researchers and farmers created gap between farmers and researchers and hindered effective interaction among them. The result of this finding supports the work of [3,7,8] that the transfer of technology from the research to farmers is through the linear process, i.e., using the research – extension - farmers' model. In this model, technology development is given to researchers whereas its dissemination is the work of extension workers and farmers are expected for implementation of the technology without getting the knowledge and skills on how to implement it. This model critically limits the interaction between farmers and researchers since extension system is working between the two stakeholders.

3.7 Diverse Activities of Extension Workers

The results from the institutions showed that extension workers in the study areas were given a number of activities that included both extension and non-extension works. Extension workers were busy with the extension works like dissemination of the agricultural technology to farmers for implementation. Moreover, they were given assignment from the political offices to organize farmers into different groups for political purposes. Extension workers were also given the task to collect government tax from farmers. Because of these pluralistic activities, extension workers did not have sufficient time to work with farmers to bring impact on farmers life though agricultural research. These multiple assignments from different bodies without proper payment and incentives discouraged extension workers to teach farmers properly about innovation in agricultural research to change their life. Since farmers did not have enough knowledge and attitude about research, they did not have good attitude to participate in research. This limited the interaction of researchers with farmers. The result of this finding support the work of [2,6] that the interaction of farmers with researchers is affected by the pluralistic activities of extension workers since they are working as agent between both stakeholders. Since extension workers are intended to work between farmers and researchers, the assignments given to them from different government bodies discouraged them to make the interaction between farmers and researchers strong.

4. CONCLUSION

The study revealed the importance of knowing factors related to farmers' characteristics that affected the linkage of farmers with researchers to bring food security in Ethiopia. From the research it was affirmed that most of the farmers did not have good perception for research and researchers. The result of the study has shown that farmers did not have positive attitude for agricultural research. Farmers looked at research as a job that only educated people could conduct. Farmers had negative perception for research and researchers because of their bad experience in the past from the agricultural research project. This showed that farmers did not get the material benefits from the research and researchers. The research revealed that weak linkage of farmers with researchers was

due to farmers' lack of adequate time for the research. Most of the poor farmers engaged themselves in social and family affairs to provide the basic necessities for their family even though a few of the poor family did struggle to be innovative for the betterment of the life of their family.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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