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Technological gaps of agricultural extension: Mismatch between demand and supply in North Gondar Zone, Ethiopia

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This paper examines technological challenges of the agricultural extension in North Gondar Zone of Ethiopia. Understanding technological gaps in public agricultural extension helps to devise demand driven and compatible technologies to existing contexts of farmers. The study used cross sectional survey using quantitative and qualitative techniques. Data were generated from primary and secondary sources using household survey from randomly taken households, focus group discussions, key informant interview, observation and review of relevant documents and empirical works. The result of study shows that there are mismatches between needs of smallholders in crop and livestock production and available agricultural technologies delivered by public agricultural extension system. The existing agricultural technologies are limited and unable to meet the diverse needs of farm households. On the other hand, some of agricultural technologies in place are not appropriate to existing context because of top-down recommendations than need based innovation approaches.

Key words: Agriculture extension, challenge, mismatch, smallholder, technology.

INTRODUCTION

Attaining sustainable agricultural development, which can be able to feed steadily growing population and support emerging industrial development and overall transformation, is possible through promoting technology transfer and adoption, boosting demand driven commercial production, deepening agricultural markets, and improving infrastructure and setting agricultural policies and strategies. Agricultural extension services have indispensable role (Federal Democratic Republic of Ethiopia - FDRE, 2014; United Nations Development Program - UNDP, 2013) through provision of applicable information, knowledge and skills along with dissemination of demanded agricultural technologies.

Ethiopia has taken series of poverty reduction strategies

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strategies and interventions under Agricultural Lead Industrialization (ADLI) framework. Various initiatives have been carried out to disseminate agricultural technology packages to farmers, which include commercial fertilizer, improved seeds, credit, soil and water conservation and provision of extension advisory services (Menale et al., 2011; Ministry of Finance and Economic Development - MoFED, 2002). However, there have been such great strides in agriculture as productivity remains low relative to the potentials (IFPRI, 2009). One of the major programs in the rural development in general and agriculture in particular is agricultural extension packages that support promotion of improved agricultural technologies and intensification (Gezahegn et al., 2006). This is expected to boost production and the productivity of smallholders.

Taken together, in order to be agricultural, extension services and technologies should be demand driven. According to Garforth (2004), demand driven denotes the information, advice and other services offered by extension professionals should be tailored to the expressed demands of the clients or recipients of the service. On the hand, studies indicate that agricultural extension is the first ranked among various service demands for rural farmers especially for those who are poor and disadvantaged groups (Kwapong, 2012).

It is apparently important to question whether the gaps in agricultural technologies are being addressed in line with felt need of smallholders. Therefore, this paper is intended to appraise technological challenges of agricultural extension services in meeting the needs of smallholder farmers with special reference to North Gondar Zone of Ethiopia.

STUDY METHODS

Description of the study areas

The study was conducted in the North Gondar Administration Zone of Amhara Regional State, located in Northwestern side of Ethiopia. It is bordered on the south by Lake Tana, West Gojjam Zone, Agew Awi Zone and Benishangul-Gumuz Regional State, on the west by Sudan, on the north by the Tigray Regional State, on the east by Wag Hemra and on the southeast by south Gondar Zone of Amhara Regional State. The area has diverse agro-ecology ranging from peak of the country which is 4,543 m above sea level (Ras Dejen) to 500 m above sea level (Alitash National Park). As the case in many parts of the country, agriculture is the dominant means of livelihoods encompassing, approximately 534,305 farm households. According to report of Amhara Regional State Bureau of Agricultural, North Gondar is the largest zone in Amhara Regional State in terms of population, area coverage and diversity of agricultural production.

Sampling and data collection methods

Cross-sectional survey involving quantitative and qualitative aspects was used and data were gathered from both primary and secondary sources. Multi-stage sampling technique was employed to catch representative areas and sample respondents. First, North Gondar Zone was purposively selected taking its representation for different agro-ecology and relatively larger share of the region. Among 23 districts (*Woredas*), four districts namely, Wogera form highland (*Dega)*, Demibia from midland (*Woina Dega*) and Metma and Quara from lowland (*Kolla*) areas were selected using purposive sampling techniques. From each district, 3-4 *kebeles* were selected using different representations in term of access to agricultural extension services. The distance from district center and availability of road and facilities were also considered as criteria to select *kebeles*. Thereafter, household respondents were selected from each *Kebele* using simple random sampling technique and 120 household respondents (representing 40 agricultural service centers) that were taken from four districts. Data were collected using different techniques and tools. Household survey using structured and semi-structured interview schedule; focus group discussion with farmers and extension experts and observation of farming systems, settlement pattern, available infrastructure including farmers training centers were important data collection techniques of the study. Data from secondary sources such as government reports, working documents and available literature were also exploited to consolidate primary data.

Data analysis methods

Data gathered from different sources, were organized and analyzed using quantitative and qualitative techniques. The quantitative data were analyzed mainly using descriptive statistics mainly using mean and percentage. The Statistical Package for Social Sciences (SPSS) application software was used to carry out the analysis of the study. Furthermore, the qualitative data obtained using focus group discussion, key informant interview and case studies were analyzed using qualitative techniques mainly by describing and contextualization.

RESULTS AND DISCUSSION

Smallholder agricultural production: Technological demand

Agricultural technologies requirements are expected to be responses to the demand of the farmers and felt problems in crop and livestock production. It is apparently important to look into crops and livestock production constraints before appraising existing technologies. Crop production, which is the main sources of income for about 68.3% of households in the study area is also the primary source of food for farm households. As far as the production is concerned, local government reports indicated that there is slight incremental trend in gross produce. However, evidences from different sources including the qualitative data of this study show that increase in gross agricultural output in the last decade was achieved by expanding land under crop cultivation, but not due to contribution of the agricultural technologies. Also, the limited supply of inputs such as improved seed and prices of fertilizer is the major pressing issues of the highland farm households. The problems of weed, pest control and labor shortage especially during the peak times of weeding and harvesting in the lowlands of the study areas are also identified to be the challenges at household level. The

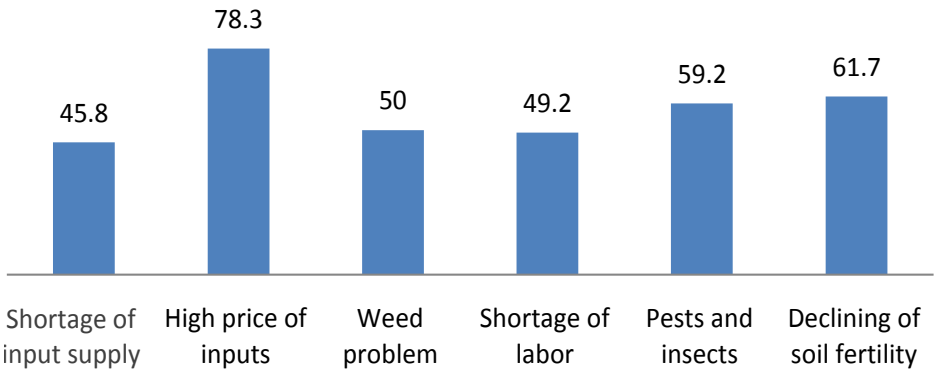

Figure 1. Problems associated with crop production as explained by farm households in %. Source: Household Survey Data (2016).

findings of this study reveal that pest and insects infestation, declining trend of soil fertility with its impact on productivity has been observed to be the major constraining issues of crop production.

It was observed that fertility of smallholder farm plots has been dependent on inorganic fertilizer for optimum yield. This has become increasingly challenging for agricultural extension service providers and farmers in both midland and highland areas of this study. Moreover, the problem is exacerbated as the demand to increase production is increasing, so that the increased cost of fertilizer can be catered for from time to time. From Figure 1 above, we can deduce that high price of inputs (78.3%), declining of soil fertility (61.7%), as well as the problem of pests and insects (59.2%) were the main factors affecting crop production based on farm households' responses.

In addition, livestock production, which is an integral part of mixed agricultural production, plays a significant role in the livelihoods of farm households. In the study areas where there is no access to financial institutes, livestock accumulation serves as the means of the saving. From randomly taken households, 8.3% household respondents reported that their income is exclusively dependent on livestock production and allied products. On the other hand, average livestock holding per household excluding poultry is found to be 5.23 TLU (Tropical Livestock Units) with significant variation between lowlands and highlands of the study areas. The lowland areas like Metema and Quara districts have relatively larger livestock population per household due to agro-ecological advantages and relatively larger area for grazing. Similarly, like crop production, the livestock component of agricultural production in the study areas, face different challenges due to many factors.

Furthermore, the absence of improved livestock breed especially in rural areas, inaccessibility of the veterinary services and demonstration sites, scarcity of animal feed, shortage of grazing land, shortage of water and animal disease are found to be major problems of the livestock production in North Gondar Zone of Amhara Region. This is illustrated in the Figure 2.

In general, major components of agricultural production have been constrained by different challenges, for instance, many farm households would require innovative technological responses to tackle the root causes of the problems and bring the system into the desired traction via gainful farm practices. Moreover, climate and environmental change problems are threatening production system and livelihoods of the rural households more than ever before, and expected to continue along with declining trends of natural resources including forest, waters and degradation of soil. In regard to this, it is important to question existing agricultural technologies, whether they are demanded or need to be embedded with innovative solutions that would take cognizance of the short comings of present day machines. This would definitely go a long way in addressing the pressing problems of smallholder farm households.

Agricultural technologies in place: The supply

Demanded, appropriate, affordable and technically feasible technologies have significant role in increasing agricultural production and productivity and lead to improvement of the livelihoods of the vast majority of smallholders. This study therefore investigates whether existing agricultural technologies are responses to the felt problems of smallholder farmers and demands. The endeavors to improve agricultural production and productivity through extension advisory and dissemination of technologies to farmers is found to be more of theoretical and political than practice. In connection with this, Rural Development and Agricultural Extension Series Report of the World Bank in 2010 noted that public agricultural extension service in Ethiopia and other developing countries is characterized by the tendency of politicians providing extension services to clients in exchange for political gains. Similarly, Bitzer et al. (2016),

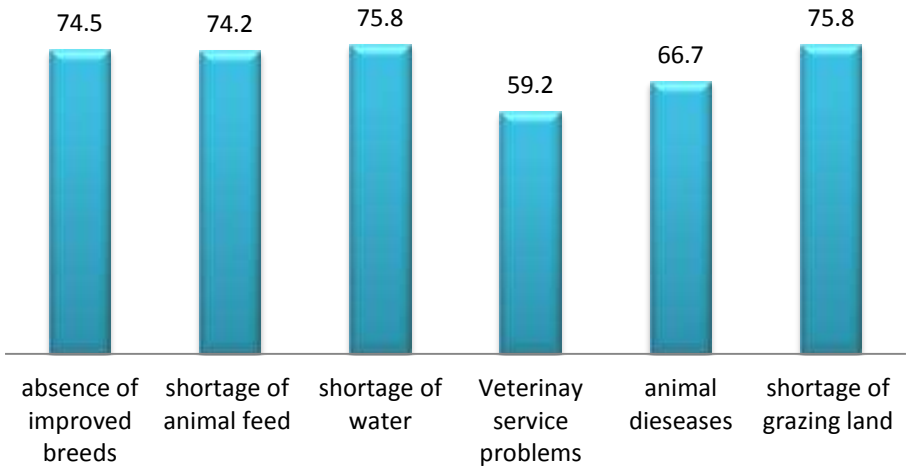

Figure 2. Problems associated with livestock production.
Source: Household Survey Data (2016).

in their review paper noted that supply driven technology transfer, weak interaction with agricultural research, misuse of extension officials for political purpose are signs of failure in agricultural extension system as it has been demonstrated in the study area. However, despite many pitfalls, agricultural extension still remains important intervention areas of government and since inception of the agricultural extension in the country in 1950s; there have been many attempts to modernize agriculture through knowledge and technology transfer in all parts of the country. In principle and structurally, almost in all parts of the study area, there are concerns that extension services is focusing on pressing issues of agriculture including crop production, animal production, natural resources management and recently irrigation in some potential areas.

Crop production enhancement technologies are dominantly focusing on fertilizer, improved crop variety and seeds, row planting, pesticide and herbicide application with limited access and geographical disparities. The findings of this study reveals that despite the long lasting efforts in providing agricultural extension services across the country, there are significant proportion of farm households who are never advised or get any technical support for different agricultural technologies of crop production by concerned extension service providers. The data from household survey also show that agricultural extension advisory service for crop production component has given less attention to pest management and storage techniques, which are the major causes of pre and post-harvest losses respectively. Concerning technological practices, there is blind recommendation of agricultural technologies because they could fit into almost all areas. Blind recommendation of technologies has been the observed challenges of crop production since political leaders attempt to convince farmers taking the good experiences of other areas without any adaptation trail and testing to the real context.

Figure 3 shows that relative to crop production, livestock production and management have attracted less attention in agricultural extension services in the study area. However, the demand for improved breads, animal feeds, veterinary services and livestock product processing and marketing is high. As far as access to information and improved breeds is concerned, 66.7, 65.8 and 35% of farm households have neither access to information nor for improved breeds of milk caw, sheep and poultry respectively. Famers from highland and midland areas have relatively better information about improved poultry and cattle breads. On the other hand, pre-urban and urban areas have good practices for hybrid cattle (in most cases with Holstein Frisians breeds) for milk production compared to rural farm household.

Concerning post-harvest handling and processing of animal precuts, agricultural extension services and technologies in promoting the livestock products such as milk processing, hide and skin are all performing below expectation where the need and contributions of such products for gross domestic production (GDP) is significant. Thought to have their own technical and managerial problems, dairy cooperative in some areas especially near towns or market centers have relatively better experience in processing and marketing. However, cooperatives as important stakeholders for agricultural extension, have limited practice in disseminating diary processing technologies to the nearby rural areas. Hence, the data obtained from household survey of randomly taken respondents indicate 77.5% of farm households do not have any information and practice about handling and management of skin and hides; whereas the rest 22.5% of respondents have information about good handling and management, but do not have any practices. The net effect of this technological gap is

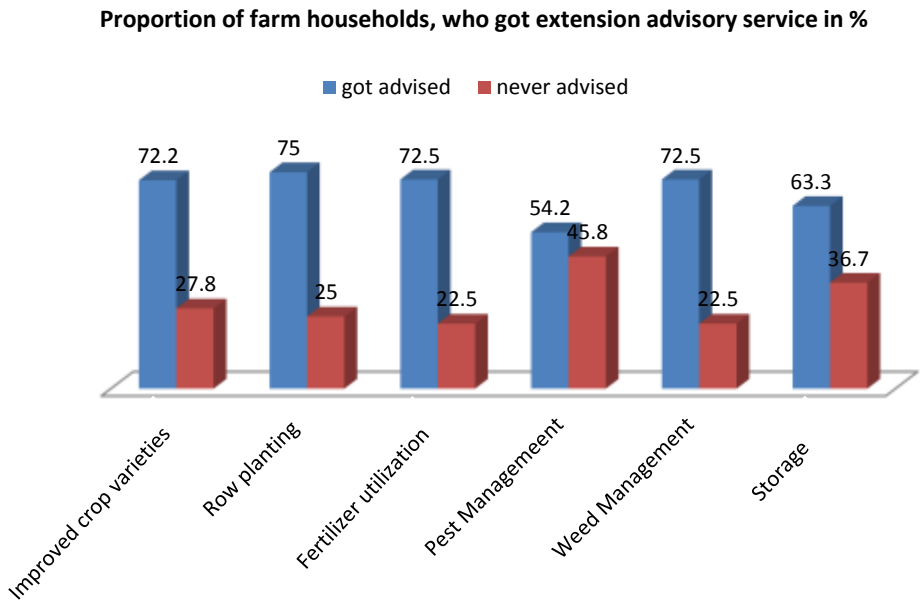

Figure 3. Available extension supports in crops production.
Source: Household Survey Data (2016).

demonstrated in hides and skins supplied by the vast majority of the rural community having poor quality with resultant farm loss to reduce the potential benefits from their byproducts.

This study observed that availability and affordability of technologies significantly affected utilization of agricultural technologies in the study area. Likewise, the high cost of technologies such as improved seeds, machineries and fertilizers have challenged farm households. Also this study finds that application of inorganic fertilizer by most of the highland and midland farms is mandatory as their plots have already developed dependency on it. However, the associated cost of fertilizer has forced famers to use less than recommended rates of application. Furthermore, there is also forced recommendation of inorganic fertilizer in areas where there is no demand and there are also farm machineries which their applications and operation are not known by farmers and even by extension agents.

The practical observation of all agricultural technologies in different areas revealed that there are gaps in demand and supply of technologies. The demanded technologies of agriculture in most cases improved seeds and varieties such as Malt Barely as the case in Wogera district are introduced without recommended package of production. The high cost, poor quality and limited variety of agricultural technologies are however observed to be major bottlenecks when promoting the needed technologies to the needy smallholder farmers. This study also finds that weak agricultural extension system in the study areas and absence of other alternative technologies have resulted in unnecessary or higher cost for smallholder farmers and waste to public institutes due to technological and supply mismatch (Figure 4).

In general, the agricultural technologies in place are neither based on the problems smallholder agriculture nor sufficient to the needs of smallholder farmers. The study has more to share with the study conducted by Belay (2003). As he has vividly noted, different extension approaches in Ethiopia have been planned and implemented without the participation of the very people for whom they have been designed. The finding of the this study also consolidate the case as planning and transfer of technologies follows top-down approach and is commanded than demanded by the needy people along with the lost linkage between farmers, extension workers and the sources of technologies.

Conclusion

Geographical and production diversity of agricultural areas as it is in north Gondar Zone of Ethiopia, have divergent problems and require different but system specific agricultural technologies both for crop, livestock and mixed cultivation. Major agricultural production components in the study area have suffered from different problems ranging from input supply to processing and marketing, demanding immediate technical support, technological response and timely information. It has been observed that existing public agricultural advisory and extension system is not designed and implemented based on felt needs of producers and it has been characterized by supply driven than participatory as well as demand driven.

As far as existing agricultural production and available

Figure 4. Unused farm machineries due to technical difficulties to demonstrate, July, 2016.

technologies are concerned, there is mismatch between the demanded and agricultural technologies available. In all, the affordability in terms of prices, for instance, the price of inorganic fertilizer, the technical feasibility of farm tools and machineries etcetera are bottlenecks of agricultural technology dissemination.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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