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Full Length Research Paper

Market channel options for smallholders in dual markets: A case of organic pineapple farmers in Uganda

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Following institutionalisation of certified organic agriculture in Uganda in 2002, more farmers have adopted organic pineapple farming to boost their economic livelihoods. However, farmers have continued to engage in the less profitable conventional market due to organic market's limited capacity to absorb all their produce. This study seeks to examine organic pineapple farmers' market choices, improve the empirical understanding of factors determining these choices and how they relate to the success of organic pineapple marketing in Uganda. Data was obtained from a random sample of 116 organic pineapple farmers from central region and three pineapple export companies, in cross-sectional household and key informant surveys. Descriptive statistics revealed that 68% of the farmers sold organic pineapples via both organic and conventional market channels at the same time. The study employed a conditional logit model to explain the factors influencing organic farmers' market channel choice which established that organic and conventional market price differences in peak and lean seasons, pineapple harvests and losses significantly influenced farmers' market choice. Farmers' organic market share can be increased by policy makers' promotion of local and regional organic market outlets and value addition at farmer and company levels.

Key words: Organic pineapple, market choice, Uganda.

INTRODUCTION

The past few decades have registered an increase in the rate of conversion from conventional to organic agricultural production in developing countries. Literature attributes this increase to the increasing global demand for organic products (Lokendra et al., 2011; Sahota, 2009), especially the high-value crops like fruits and vegetables (Gehlhar and Regmi, 2005). The demand is highest in the developed world, mainly in North America and Europe (Willer et al., 2018; Willer and Schaack, 2015). A fast growth of the global market for high-value crops offers substantial incentives for farmers in developing countries, like Uganda to increase production.

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It might also act as an avenue that fosters potentialincome growth (Gulati et al., 2005). However, as noticed by the authors and Markelova et al. (2009), contrary to the advantage of increasing demand of high-value crops that foster increased productivity and income, which is good for the majority of poor smallholder farmers, it also presents new challenges. The challenges relate to farmers' increased involvement in long and sophisticated supply chains, characterised by stringent food safety standards, required mainly by the international markets. This also augments the market failures experienced by such farmers, as their prospects to increase incomes progressively depend on their ability to compete in constantly evolving markets. Nevertheless, organic products like pineapples are still enjoying a niche export market (Kleemann et al., 2014) which if tapped, can offer opportunities to the smallholder farmers in the developing countries like Uganda.

In Uganda, organic pineapples constitute about 75% of the total exported fruit crops (Namuwoza and Tushemerirwe, 2011). However, this percentage, according to Namuwoza and Tushemerirwe (2011), has been gradually declining due to high freight costs, owing to bulkiness of the fresh pineapples, hence, reducing the crop's competitiveness on the global market. Besides, the shift in consumption trends of the pineapple varieties on the world market, particularly from smooth cayenne, a variety that formally dominated the market with about 90% market shares in the 1980s, to MD2 variety contributed significantly to the decrease of Uganda's total organic pineapple export volumes. MD2 was introduced in Costa Rica in the early 2000s and has since dominated the world market (Kleemann et al., 2014; Fold and Gough, 2008). This variety is by far considered the standard pineapple variety consumed in the EU, which over the years has been the major importer of the smooth cayenne variety mainly grown in Africa and Uganda in particular.

Currently, organic pineapple production in Uganda is encouraged by a premium price in the export market, for which a market chain has developed with certified organic farmers selling to export companies. The challenge for farmers is, however, the consumers' preference shift to MD2 pineapple variety. Stringent export quality standards that organic farmers must adhere to, also present a challenge (Chiputwa et al., 2015).

Farmers are contracted by companies to produce quality organic pineapples and they expect to recover their production costs via the premium price paid for the produce. However, in the contracts, the export companies only specify the required pineapple quality attributes and the prices of pineapples during the peak and lean supply seasons. Quantities to be bought are not specified. Worse still, the companies do not buy all the farmers' produce, particularly during the peak seasons. As a result, farmers face a market choice question as to whether to sell part or all of their organic pineapples to the conventional or the organic market.

Various researchers have compared organic and conventional farming in Uganda, mainly in relation to profitability (Bolwig et al., 2009) and smallholders' food security (Bolwig, 2012; Walaga and Hauser, 2005). There is, however, limited information about the factors that influence organic pineapple farmer's choice to participate in either the organic or conventional market in the country. Yet this information is vital in devising interventions to help the non-homogeneous farmers whose marketing decisions may not be uniformly rewarding. This can be done by mitigating marketing challenges like oversupplying an already constrained organic market, characterized by varying consumer tastes and preferences.

The current study seeks to examine the alternative organic pineapple farmers' market choices in order to improve on the empirical understanding of factors determining these choices and how they relate to the success of organic pineapple marketing in Uganda. Here, success is defined as the amount of pineapples sold via the organic market, as a proportion of total pineapples harvested. The study is mainly based on the hypothesis that price differences (premiums) between the organic and conventional pineapple markets during peak and lean seasons are the major influencing factors for organic farmers' market choice and the share of pineapples sold to either organic or conventional markets.

METHODOLOGY

Study area, data and sampling procedure

The study was conducted in the central region of Uganda, in two districts (Kayunga and Luwero). The districts were purposively selected for being the leaders in pineapple production in the country (Bolwig, 2012), hence a good representative of the country. Farming is the main income activity in the two districts where more than 80% of the population draws its economic livelihoods from pineapple farming (NPHC, 2014) as the dominant agricultural activity. Primary data were generated from a cross-sectional household survey in 2016. Representatives of the organic export companies to which farmers are affiliated were also interviewed in relation to organic pineapple production standards and marketing aspects. A structured questionnaire and a checklist were used to collect the data from farmers and company representatives respectively. For farmers, variables of interest included their age, sex and pineapple marketing experience, years taken by a farmer to be certified organic, pineapple price differences (in US Dollars) during peak and lean pineapple seasons and total annual quantities of pineapples harvested, sold and lost among other variables. At the company level, the study mainly looked at variables to do with how the companies institutionally relate with farmers during production and marketing of the pineapples. Examples of variables that were studied here include the major pineapple production contract specifications and fulfilment by both farmers and companies, the practices set by companies for farmers to produce the required pineapple quality and mode of operation by farmers during production and marketing transactions. That is whether farmers operate in groups or as individuals. Focus group discussions (FGDs) were also conducted at the farmer level with an

objective of investigating the factors that relate to the strategic behaviour of farmers (both organic and conventional) and the provided information about how pineapple farmers cope with the socio-economic conditions in their areas, their other livelihood strategies in addition to the pineapple business and labour availability and access during pineapple production and marketing.

To select representative farmers, sampling was conducted systematically, from purposive selection of districts to probability proportional to size sampling, as specified by Bar-Hillel (1979) and Kothari (2004). Consultations were made with the National Organic Movement for Uganda (NOGAMU) officials to develop the sampling frame for both organic pineapple farmers and the export companies. Three companies (named A, B and C for purposes of confidentiality) were considered for the study. The companies provided lists of pineapple farmers with whom they were affiliated, which were used to randomly select 116 farmer respondents for the study. Based on the common features of farmers attached to the three export companies that were considered, we had three strata that is, three groups of farmers affiliated to three export companies. Sample sizes from the three strata were drawn using proportional to the size sampling method. Three lists of farmers attached to the export companies were provided; 160 farmers with an affiliation to company A (stratum 1), 154 to company B (stratum 2) and 139 to company C (stratum 3). This yielded a total of 453 organic pineapple farmers as the population to sample from. Out of the total sample population, farmers affiliated to company A constituted 35.3%, those affiliated to company B accounted for 34.43% and those affiliated to company C were 30.17%. Therefore, using proportional allocation, the sample sizes for our three strata were 41 company A farmer affiliates, 40 company B farmer affiliates and 35 company C farmer affiliates giving a total of 116 organic pineapple farmers.

Conceptual framework

Literature postulates that market share variability relies on various factors including household socio-economic structures, price fluctuation of agricultural commodities, access to profitable markets and favourable conditions for agricultural potential (Ayenew and Firew, 2014; Gibbon, 2006). In a similar direction, Obi et al. (2011) note that market selection process is subject to market characteristics, efficiency and associated costs, or it can be affected by product related information in terms of product quality, product availability and its associated prices (van Schalkwyk et al., 2012). Market selection has also been explained by Dolan and Humphrey (2000) as an analysis of influencing factors including, product quality together with its compliance with quality standards and procedures.

Selection of a market channel is one of the crucial decisions farmers must make prior to marketing of their produce (Soe et al., 2015; Park and Lohr, 2006). Organic pineapple marketing in Uganda is characterised by a composite nature of farmers who consider a number of financial and non-financial facets before making market channel choice decisions. Moreover, a producer's choice of a marketing outlet according to Park and Lohr (2006) is dependent on his/her utility maximization, outlet characteristics and the producers' marketing experience. In addition to farmer and farm characteristics, transaction costs form another major part of the marketing channel choices among producers (Woldie and Nuppenau, 2011).

In Uganda, pineapple has two distinct harvest seasons; peak and lean. Export companies usually buy only a fraction of organic pineapples at a fixed price from the farmers during the peak season. Peak season is a period during which the conventional market (CM) which serves as an alternative for absorbing the surplus organic pineapples is also saturated. Conventional market price fluctuates between seasons and is presumed relatively higher in the lean season. Given the pineapple seasonality and price changes, there are three market choice options for the organic farmers. First, if we let Q_S be the quantity of pineapple sold either to the organic market; OM (Q_{OM}) or to CM (Q_{CM}), then:

$$Q_S = Q_{OM} + Q_{CM} \quad (1)$$

Secondly, if we let the proportion of pineapple quantity sold to the OM be α, then:

$$Q_S = \alpha Q_{OM} + (1 - \alpha Q_{OM}) \quad (2)$$

And the resultant market choice options are such that;

a. If the farmer sells all the pineapples to (*OM*), then:

$$Q_S = Q_{OM} \quad (3)$$

And this farmer's revenue:

$$R_{OM} = Q_{OM} * P_O \quad (4)$$

b. If the farmer sells all his/her organic pineapples to CM, then:

$$Q_S = Q_{CM} \quad (5)$$

And his/her revenue amounts to:

$$R_{CM} = (1 - \alpha Q_{OM}) * P_{CM} \quad (6)$$

If he/she sells a given pineapple proportion to *OM* and another one to *CM* within the same season, Equation 1 applies and the revenue that accrues to this farmer amounts to:

$$R_{OMCM} = \alpha Q_{OM} * P_O + \left((1 - \alpha Q_{OM}) * P_{CM}\right) \quad (7)$$

The three market channel scenarios as illustrated depict a single season situation, for instance, the peak season. Therefore, similar computations are considered for the lean season.

Analytical framework and model estimation

To evaluate the organic pineapple farmers' constrained market channel choice, a logistic regression was used to assess the factors that influence their choice to sell organic pineapples through CM. The theory behind the logistic regression model has been well explained by literature (Hosmer et al., 2013; Allison, 2012; Menard, 2002; Hosmer and Lemesbow, 1980). Literature acknowledges logistic regression as a powerful, flexible and appropriate tool that has been used extensively to model categorical dependent variables with dichotomous observable realisation, given a set of both categorical and continuous explanatory variables (Hosmer et al., 2013). Applying the choice theory to the present situation of constrained choice, this study relates the probabilities of the two prevalent market options to a set of behavioural rules that reveal the organic farmers' market option decision preferences.

Park and Lohr (2006) asserted that a producer chooses a market channel depending on the utility that he/she derives from it. In our case, OM is of priority, but it is characterized by low quantity

Table 1. Explanatory variables hypothesised to influence organic pineapple farmers' decision to sell pineapples via the conventional market.

Variable	Variable description	Expected sign of the relationship
Y	Dependent variable (binary): (Organic market only = 0, Both organic and conventional=1	
X_1	Age of the farmer (number of years)	-
X_2	Sex of the farmer (1= male, 0 = otherwise)	+
X_3	Marketing experience (Time in years since the farmer started pineapple marketing business)	+
X_4	Conversion period (years taken by the farmer to convert to certified organic farming	-
X_5	Years spent in contractual agreement (0 if no contract existed)	-
X_6	Quantity (tons) of pineapples harvested annually	+
X_7	Distance in kilometres travelled by the farmer from the pineapple garden to the main market	-
X_8	Mode used by the farmer to sell the pineapples (1= individual, 0=group marketing)	+
X_9	Pineapple price differences (USD) in organic and conventional markets during peak season	-
X_{10}	Pineapple price differences (USD) in organic and conventional markets during lean season	-
X_{11}	Total annual pineapple (tons) lost	-
X_{12}	Annual quantity of dried pineapple chips sold (kg)	-
X_{13}	Farmer's actual pineapple selling point (1=on farm gate, 0= off farm)	+/-
X_{14}	Contract initiated by the company (1=yes, 0= no)	-
X_{15}	Contract has ever been amended (1=yes, 0= no)	-
X_{16}	Company pays on delivery (1=yes, 0= no)	-

pineapple purchases. Organic market contracts that only specify pineapple prices but not the periodic quantities to be bought leaves farmers with pineapple surpluses that must be disposed of. The search for the surplus produce buyers compels the farmers to sell organic pineapples via the unintended CM. With an application of the logit model, an organic farmer *i* is assumed to have *k* market options, (*k*=1, 2). This orients our analysis to a binary choice between two market channels, modelled as a function of the level of one or more of the considered explanatory variables as shown in Table 1, such that the dependent variable:

$$Y^{*} = \begin{cases} 1, \text{if the } i\text{th farmer sold to both OM and CM at the same time} \\ 0, \text{otherwise} \end{cases} \quad (8)$$

However, since the logit model probabilities related to the dependent variable are bound to 0 and 1, rendering *X* and *Y* void of linear relationship, a transformation of the categorical dependent variable to an odd ratio was done to enable *Y* assume a linear relationship with the explanatory variables (Allison, 2012).

The logistic regression model as used by this study took the following form:

$$\text{Logit}\,(Y_i^{*}) = \ln\left(\frac{Y_i}{1-Y_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \ldots + \beta_n X_n \quad (9)$$

Where; $\ln\left(\frac{Y_i}{1-Y_i}\right)$ is the conditional logit for pineapple market channel choice, equalling to 1, if an organic farmer sold to both markets, or 0 otherwise, β_0, the constant term, β_1 to β_n, the estimated parameters and X_1 to X_n, the independent variables.

We used the Z-test to test the hypotheses on price differences during peak and lean seasons as:

1. H_0 : β (market channel) premium price peak = 0, and,
2. H_0 : β (market channel) premium price lean = 0

RESULTS AND DISCUSSION

Characteristics organic pineapple farmers in Uganda

Different organic and conventional pineapple market chains in Uganda were identified by this study. It was however established that organic pineapple famers predominantly participate in two main markets, namely; OM and the open market, usually referred to as CM. The option of organic farmers selling via CM results from the inability of organic export companies to purchase all the organic pineapples produced, mainly during peak harvest seasons. Figure 1 summarises the general overview of the pineapple market chains in Uganda, as identified in this study. The chains segmented in three groups including those at the village or local level, and the national and the international levels.

An assessment was done on the two distinct groups of the organic pineapple farmers as identified by this study (those that sold via the OM (export companies) only and those that sold through both OM and CM) to identify the similarities and the differences between the them with regard to demographic, socioeconomic, farm and market related characteristics. Table 2 presents results about farmer and farm specific characteristics, while Tables 3 and 4 present market related variables, thought to have potential influence on the organic pineapple farmer market choice. Of the total 116 studied farmers, 68% sold pineapples via both OM and CM channels in the same season. This percentage is evidently larger than that of the farmers who sold via only the originally intended OM channel.

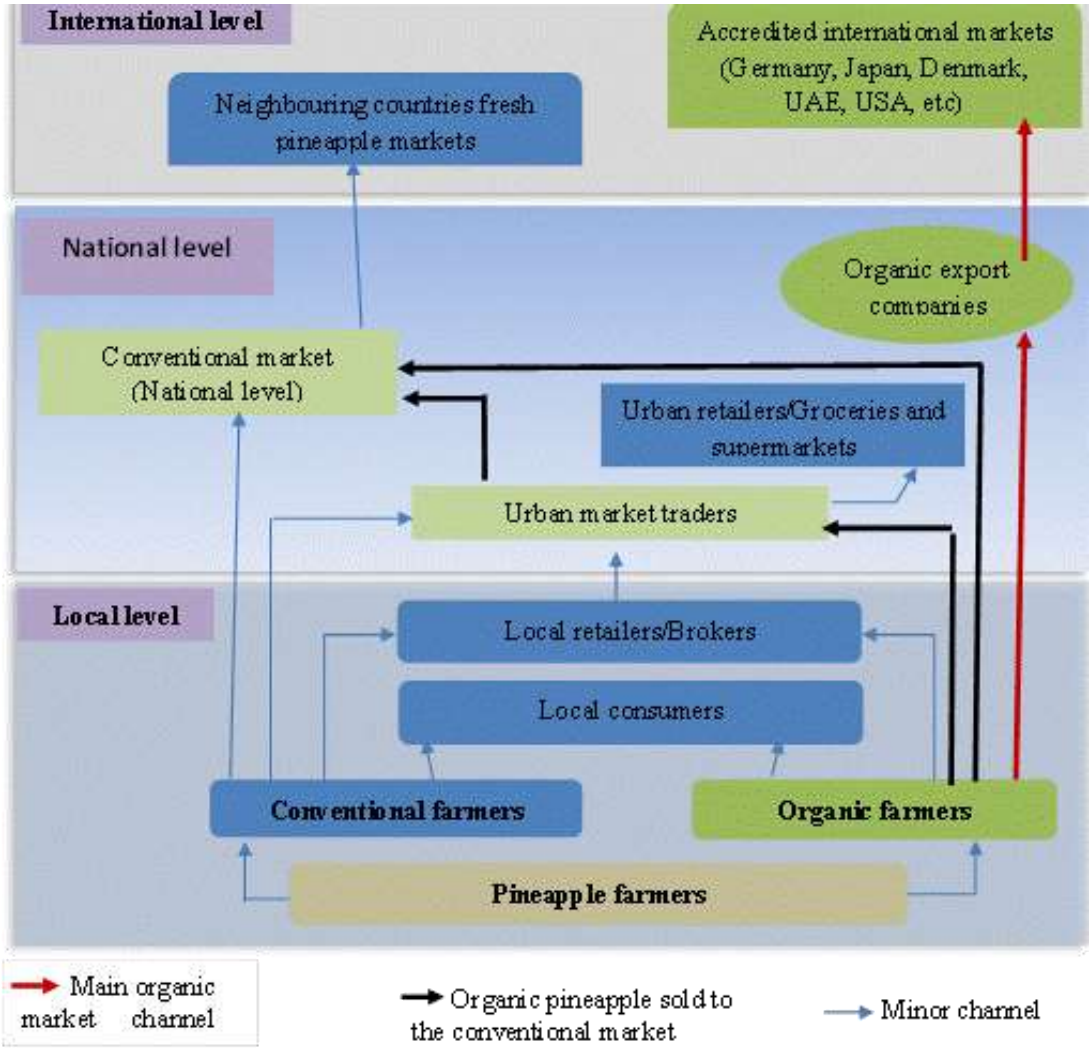

Figure 1. Pineapple market chains in Uganda.
Source: Own illustration

Farmers who transacted in both markets were significantly younger (P≤0.10) than those who sold through only OM as shown in Table 2. As revealed by information obtained from the FGDs and individual farmers during the interview, selling pineapple to CM usually requires organic farmers to travel relatively longer distances in search for the market for pineapples that are originally intended the organic market (export companies). These transactions require effective coordination, a process that requires relatively young and energetic farmers, as also established by Ayoola et al. (2011).

The majority of farmers that engaged in both markets were males as described in Table 2. Generally in the study area, male farmers have better access to agricultural production and marketing resources as compared to the female farmers especially for commercial crops like pineapples. Similar results have been reported by various scholars including Oseni et al. (2015) and Croppenstedt et al. (2013).

With reference to Table 2 regarding farm specific characteristics, farmers that sold pineapples to OM only got much of their total annual income from pineapple sales (P≤0.10). Probably, this result comes from the fact that pineapple growing, as reported by farmers during FGDs, is the main income generating activity that most farmers in the area are involved in.

Results further show that farmers who sold via both markets harvested significantly more pineapples (P≤0.01) than their counterparts as shown in Table 3, and sold significantly more (P≤0. 01) to CM as depicted in Table 4, than the quantities sold to OM by farmers that used only the OM channel, especially during the peak season. During the lean season, farmers that used OM only, sold significantly more pineapples (P≤0.01) than the organic proportion sold to CM, by farmers who used both markets. This is further reflected by the significantly more

Table 2. Organic pineapple farmer and farm specific characteristics.

Farmer specific characteristic	Market channel [mean (SD)]		P-value/x^2
	Organic only (n=37)	Both organic and conventional (n=79)	
Age of farmer (years)	47.11 (11.98)	43.33 (11.14)	0.099
Farmer's formal education (years in school)	7.70 (3.38)	8.28 (3.12)	0.369
Number of working age household members (15-65 years)	3.30 (1.51)	3.32 (1.54)	0.950
Sex of the farmer (% male)	56.76	72.15	0.100
Farming experience (years)	22.41 (11.96)	18.46 (10.08)	0.067
Pineapple farming/marketing experience (years)	13.27 (9.41)	11.13 (6.39)	0.153
Distance(km) from pineapple farm to the main market	9.00 (11.07)	9.40 (7.31)	0.862
Percentage of income from pineapple sales	96.11	90.36	0.072
Household's main pineapple marketing mode (individual) (%)	78.38	73.42	0.692
Farmer sells pineapples only at farm-gate (%)	13.51	24.05	0.192

Figures in brackets are the standard deviations; 1USD=3,400 Uganda shillings at the time of the study.
Source: Survey data (2016).

Table 3. Organic pineapple output and sales descriptive results as a basis for market choice model.

Variable	Market channel used by the farmer [mean (SD)]		P-value
	Organic only (n=37)	Both organic and Conventional (n=79)	
Tons of fresh pineapple harvested in peak season	5.479 (5.558)	9.658 (8.025)	0.009
Tons of fresh pineapple harvested in lean season	3.568 (3.334)	3.473 (3.672)	0.907
Tons of fresh pineapple lost in peak season	0.781 (0.787)	1.023 (1.094)	0.275
Tons of fresh pineapple lost in lean season	0.308 (0.295)	0.282 (0.292)	0.724

Figures in brackets are the standard deviations.
Source: Survey data (2016).

income (P≤0.01) earned by farmers that used OM only during the lean season as described in Table 4. In addition, during the peak season, farmers that sold all their pineapples to the OM received a significantly higher price (P≤0.01) per kilogram of pineapples sold than their counterparts as shown in Table 4. This is possibly an incentive for farmers that sell to OM only. These results are further confirmed by the significantly higher price margins (premiums) offered to farmers that sold all the pineapples to OM only in the peak (P≤0.01) and lean (P≤0.01) seasons.

Econometrics model result

Before running the conditional logit model which was employed to identify influencing factors of organic pineapple farmers' market choice decision to participate in the conventional market, a multicollinearity test; variance inflation factor (VIF) for variables specified for the model was done and its results are presented in Table 5.

Based on the VIF results, we found no correlation between the independent variables that were considered for the model. The model results presented in Table 6 showed that organic farmers' decision to participate in the conventional market was significantly influenced by seven of the sixteen independent variables that were used to estimate the model. These include, total annual pineapple quantities harvested, total annual pineapple quantities lost, organic market premium prices in peak and lean seasons, farmers' pineapple marketing experience, distance in kilometres travelled by the farmer from his/her pineapple farm to the main market and the number of years spent by the farmer in the organic pineapple production contract.

Every additional ton of harvested organic pineapples increased the odds of selling to both OM and CM by a factor of 1.08, holding other variables constant. This could partly be attributed to the nature of contracts between the farmers and export companies that only specified the price but not the quantities to be bought. Farmers with surpluses unbought by organic buyers were therefore left with only the option of selling through CM. Park and Lohr (2006) reported similar results and singled out seasonal effects as a major factor that distorts

Table 4. Additional descriptive results from selected market choice model variables between farmers who sold to the organic market only and those who sold to both markets.

Variable	Market channel used by the organic farmer				
	All to organic market (n=37)	Portion sold to organic market by farmers who sold to both markets (n=79)	P-value	Portion sold to conventional market by farmers who sold to both markets (n=79)	P-value
Tons of fresh pineapple sold in peak season	3.887 (3.605)	4.972 (5.462)	0.331	6.034 (5.503)	0.010
Tons of fresh pineapple sold in lean season	2.935 (2.839)	2.021 (2.791)	0.164	1.412 (1.927)	0.000
Average market price during peak season (USD/kg)	0.141 (0.064)	1.164 (0.08)	0.174	0.086 (0.051)	0.000
Average market price during lean season (USD/kg)	0.186 (0.098)	0.201 (0.106)	0.280	0.176 (0.080)	0.184
Average market price differential/margin during peak season (USD/kg) (Op-Cp)	0.125 (0.078)	0.045 (0.099)	0.000	0.045 (0.011)	0.978
Average market price differential/margin during lean season (USD/kg) (Op-Cp)	0.176 (0.104)	0.036 (0.174)	0.000	0.036 (0.020)	0.980
Average income from pineapple sales in peak season (USD)	538.368 (499.661)	821.887 (965.554)	0.130	605.148 (568.195)	0.401
Average income from pineapple sales in lean season (USD)	551.373 (514.891)	377.615 (454.669)	0.112	353.857 (352.947)	0.000

Figures in brackets are the standard deviations; 1USD=3,400 Uganda shillings at the time of the study; Op and Cp refer to organic market price and conventional market price, respectively.
Source: Survey data 2016.

equilibrium output in a given market, a situation that pushes farmers to seek alternative market channels for their organic produce.

The study also found that every additional ton of organic pineapples lost or wasted during the post-harvest process, decreased the odds of an organic farmer selling to both OM and CM by a factor of 0.42. These findings indicate that the more pineapples are registered as losses during and after harvesting, the less pineapple surpluses. Pineapple losses are increased by delayed or absence of the company representatives during pineapple collection periods. Evidence shows that farm losses in horticultural crops can go as high as 16% (Murthy et al., 2009). This accounts for economic losses to the farmer in form of lost income.

With regard to organic premium prices (our major hypothesis variable), results show a decrease in the odds of an organic farmer selling to both OM and CM by factors of 0.001 and 0.007 in the peak and lean seasons, respectively, with a unit increase in prices as shown in Table 6. In other words, the price differences act as incentives for farmers to respect their organic contracts. Based on these results, we reject the null hypothesis that price differences between OM and CM during peak and lean seasons are the major influencing factors for organic farmers' market choice and the share of pineapples sold to either OM or CM. With reference to Table 4, results indicate a higher OM price than the CM price in both seasons, but still, farmers continue selling to CM. Therefore, other factors, also greatly contribute to the failure of the OM.

Organic farmers' pineapple marketing experience (years) was associated with a reduction in the odds of their decision to transact in CM by a factor of 0.92. As stated by Park (2009), certified organic farmers are willing to allocate time and other resources to get acquainted with the available organic practices. This experience may translate into more knowledge about different marketing opportunities where by farmers are more likely to develop

Table 5. Variance inflation factor test results.

Variable	VIF	1/VIF
Total annual pineapple quantities harvested (t)	1.66	0.601
Total annual pineapple quantities lost (t)	1.44	0.695
Organic market premium price in peak season	1.33	0.751
Organic market premium price in lean season	1.56	0.641
Contract initiated by organic company (dummy)	1.37	0.729
Contract has ever been amended (dummy)	1.55	0.643
Mode of payment (1 = cash on delivery, 0 = paid later)	1.29	0.773
Number of years taken to convert to organic farming	1.28	0.784
Pineapple marketing experience (years)	1.42	0.702
Mode used by farmers to market pineapple (1 = individually, 0 = group)	1.43	0.697
Distance (km) from pineapple farm to the main market	1.26	0.796
Specified organic contract period (years)	1.33	0.751
Annual dried pineapples chips sold (kg)	1.2	0.831
Sex of the household head (male =1, female = 0)	1.18	0.848
Age of the household head (years)	1.43	0.699
Farmer's pineapple selling point (1 = farm gate, 0 = off farm)	1.43	0.702
Mean VIF	1.39	-

Source: Authors' own computation based on survey data (2016).

diversified sets of market outlets within their niche. For instance, they may venture into value addition; say pineapple drying in our case. This way, the organic pineapple farmers have limited chances to appear as actors in CM.

On the contrary, however, every added year on the contract period between farmers and the company, increased the organic farmers' odds to sell via CM by a factor of 1.45. Probably, the more time the farmers spend in this kind of marketing arrangement, the more they are likely to predict the trend of pineapple seasonal variations and the quantities procured by the companies. Perhaps this also helps them establish working relationships with the conventional buyers early enough, in case they anticipate availability of pineapple surpluses. Literature on social systems shows that building social connections, reciprocity and trust takes time (Hinrichs, 2000), with social ties being crucial in altering and enhancing human economic interactions (Portes, 2014).

Lastly, every additional kilometre between the organic farm and the main conventional pineapple market reduces the odds of selling organic pineapples to CM by a factor of 0.97. This is an indication that organic farmers away from such markets are most likely to lose their pineapples, if the company fails to buy all of them. This result is in line with our a priori expectation as presented in Table 1. Usually, the companies pick the pineapples from the farmers' fields. The farmers, given their production and marketing strategies, may therefore not find it economically viable to travel in search of the CM. Moreover, such transactions are associated with extra costs including produce transportation and market information search costs. As a result, farmers may prefer selling within the smallest radius possible from their fields. Xaba and Masuku (2012) and Makhura (2001) similarly established a negative relationship between distance to the market and informal farmer market channel choices.

CONCLUSION AND POLICY IMPLICATIONS

This article analysed and discussed the factors that influence organic pineapple farmers' choice decision to participate in CM using a conditional logit model. The study identified the two main market channels used by the organic pineapple farmers in Uganda as; (1) one where the farmers sell pineapples to OM only (organic export companies), and (2), where farmers sell part of the organic pineapples to CM. One specific finding from this study is that the price margins between OM and CM during the peak and lean season, as earlier hypothesized, negatively and significantly influence organic pineapple farmers' probability to participate in CM. Total annual pineapples registered as losses, farmers' pineapple marketing experience, and distance from pineapple farms to the farmers' main market also negatively influenced this decision.

On the contrary, the study showed the tonnage of annual pineapples harvested and the period (years) spent in contract by farmers, as variables that positively and significantly influence organic pineapple farmers' participation in CM. These factors together, provide a general overview of the functionality of OM in the country which makes the study relevant for scholars interested in the OM studies related to institutional arrangements, a

Table 6. Determinants of organic pineapple farmers' decisions to sell to the conventional market (Logit model).

Variable	Coef.	Std. Err.	b	z	dy/dx	P>z	e^b	e^bStdX	SD of X
Total annual pineapple quantities harvested (t)	0.079	0.036	0.079	2.181	0.006	0.029	1.082	95.441	57.774
Total annual pineapple quantities lost (t)	-0.862	0.304	-0.862	-2.832	-0.063	0.005	0.422	0.111	2.552
Organic market premium price in peak season	-6.567	3.766	-6.567	-1.744	-0.478	0.081	0.001	0.518	0.100
Organic market premium price in lean season	-4.943	2.539	-4.943	-1.947	-0.360	0.052	0.007	0.437	0.168
Contract initiated by organic company (Dummy)	0.535	0.700	0.535	0.765	0.044	0.444	1.708	1.251	0.419
Contract has ever been amended (Dummy)	-0.216	0.952	-1.216	-1.278	-0.115	0.201	0.296	0.583	0.444
Mode of payment (1= cash on delivery, 0= paid later)	1.009	0.682	1.009	1.479	0.080	0.139	2.743	1.652	0.497
Number of years taken to convert to organic farming	0.146	0.411	0.146	0.354	0.011	0.723	1.157	1.117	0.762
Pineapple marketing experience (years)	-0.083	0.043	-0.083	-1.929	-0.006	0.054	0.920	0.535	7.512
Mode used by farmers to market pineapple (1= individually, 0= group)	1.003	0.895	1.003	1.121	0.060	0.262	2.726	1.547	0.435
Distance (km) from pineapple farm to the main market	-0.028	0.013	-0.028	-2.115	-0.002	0.034	0.972	0.240	51.010
Specified organic contract period (years)	0.371	0.153	0.371	2.420	0.027	0.016	1.450	4.106	3.805
Annual dried pineapples chips sold (kg)	-0.003	0.002	-0.003	-1.607	-0.000	0.108	0.997	0.469	268.555
Sex of the household head (male=1, female=0)	1.098	0.731	1.098	1.502	0.096	0.133	2.999	1.678	0.471
Age of the household head (years)	-0.022	0.030	-0.022	-0.723	-0.002	0.469	0.979	0.781	11.500
Farmer's pineapple selling point (1=farm gate, 0= off farm)	1.486	1.056	1.487	1.407	0.159	0.159	4.421	1.831	0.407
Constant	-0.361	2.087	-0.361	-0.173	-	0.863	-	-	-
Model summary			Number of observations					= 116	
	Logistic regression		LR chi2(16)					= 67.48	
			Prob > chi2					= 0.000	
	Log likelihood		= -38.888161						
	Pseudo R2		= 0.465						
H_0: β (Market channel)premium price peak = 0; $chi^2(1) = 3.04$ and Prob > $chi^2 = 0.081$									
H_0: β (Market channel)premium price lean = 0; $chi^2(1) = 3.97$ and Prob > $chi^2 = 0.052$									

e^b = exp(b) = factor change in odds for unit increase in X; e^bStdX = exp(b*SD of X) = change in odds for SD increase in X; SDofX = standard deviation of X.

case in point, market failures due to contracts between producers and the buyers of organic products.

The negative sign attached to the amount of annual pineapple losses should be a pointer for both the company agents and the farmers work together to improve their access to pineapple value addition strategies. For instance, export companies can venture into pineapple drying and through credit schemes and also empower farmers to follow suit so as to enable pineapple product differentiation, a practice that can significantly reduce pineapple losses and help the organic farmers to benefit from their extra efforts to produce organically. Improving the shelf life of the produce, through value addition can also encourage organic product diversification by the companies, beyond handling only fresh fruits. As a result, more farmers' pineapple produce will be bought by the companies, especially during peak seasons (Choudhury, 2006). That way, the proportion of pineapples wasted and those sold to CM due to smallholder farmers' lack of resources and suitable postharvest handling equipment,

are reduced.

Based on this study's results, the stakeholders in the organic sector in Uganda need to establish, strengthen and expand local and regional organic niche markets which can absorb part or all the organic pineapples registered as losses and those sold to CM, rather than entirely depending on international markets. It is therefore pertinent for the organic farmers and buying companies to lobby agricultural policy makers to support the organic marketing systems through effective policies and strategies that promote local and regional OM outlets. We recognise the fact that pineapples are highly perishable and therefore recommend that companies should respect the contracts as regards the aspect of timely collection.

CONFLICT OF INTEREST

The authors have not declared any conflict of interests.

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Socio-economics characterization of agricultural farming system in Oromia Regional State of Ethiopia: Case of AGP-II districts participatory rural appraisal (PRA) model

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This paper presents the farming system dynamics in Agricultural Growth Project II and applied a PRA model. The objective was to characterize the farming systems of AGP-II districts and identify production constraints. We investigate how historical trends have influenced the farming system, using data from desk review surveys, semi-structured interviews, focus-group discussions; key informant discussions and observations; by investigating two sample districts of AGP II; these were Ambo and Girar Jarso of Oromia regional state of Ethiopia. From each district two PAs were selected randomly applying stratified sampling techniques for AGP II districts. Findings indicate a high disparity in the characterization of wealth and status; that requires intervention to minimize gaps with agricultural technologies; the micro finance institutions have a long way to go to support the input service thought it has increased from 5% in 2012 to 8%in 2017 credit supply. Farmer training centers 65% of them aren't functional in Ambo district. Average yield per hectare in kg were found 3,700, 3,101, 2,800, 2,100 were for maize, sorghum, wheat and barley respectively; while the average market price per kg was 7 Ethiopian Birr which was 0.31 USD (June/2017 average exchange rate 22.91 Birr/1 USD). While tef, chickpea and lentil was 1,801, 2,300 and 1,800 respectively, with average market price per kg was 20, 24, and 21 Ethiopian Birr which was 0.9, 1.1 and 0.9 USD. So; intervention of technologies has to consider profitability and other necessary parameters.

Key words: Farming system, wealth status, Agricultural Growth Program-II (AGP-II), food security, agricultural technologies.

INTRODUCTION

The agricultural growth in Ethiopia as a contributor to overall economic growth has been remarkable for Africa and the world (Diao et al., 2008; Djurfeldt et al., 2008). National official data show that agriculture has grown on

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average by 7.6% per year over the last decade, and this agricultural growth in particular has been a major contributor to the important poverty reductions observed in the last decade in Ethiopia (World Bank, 2014). Its strategic importance lies in its forward and backward integration with the rest of the economy, the establishment and maintenance of food security, the economic welfare of rural-urban and stabilization capabilities in relation to the balance of payments. In developing countries like Ethiopia, rural development plays a crucial role in economic development and the alleviation of poverty.

Agricultural innovation is a necessary condition to accelerate productivity and achieve food security in Africa. Recent efforts focus on designing mechanisms to overcome constraints on farmers' adoption, such as underdeveloped input delivery systems (Shiferaw et al., 2008), high acquisition costs (Suri, 2009), and time inconsistency (Duflo et al., 2011). A growing literature recognizes the role of information failures in the agricultural technological diffusion process, focusing on conditions for effective communication between peers (Duflo, 2010; BenYishay and Mobarak, 2013). Despite its formative effect on diffusion, evidence on the efficacy of extension to help farmers overcome information failures is mixed. Recent experiments show potential in improving learning and adoption through participatory approaches in extension, e.g., field trials, farmer field schools, and innovation platforms (Duflo et al., 2011).

Agricultural growth program (AGP)

In the GTP-I period, agriculture sector has been striving to enhance economic growth especially in the agriculture sector. Overall economy has been growing at the rate of 11% per annum for which AGP has also been one of the development initiatives of the government that has made substantial contributions. AGP is a multifaceted investment program supporting agricultural productivity and commercialization focusing on high agricultural potential areas to address some of the key constraints to agricultural growth and thereby contribute to overall economic growth and transformation. It is a program approach which is being viewed as one of the key investment mechanisms for development partners and government to collaborate on.

AGP-II operates in 157 district selected from 7 national regional states and one city administration of the country which have the highest growth potential, primarily based on agro-ecological conditions and access to markets. The 96 district that benefited from AGP-I interventions are also beneficiaries of AGP-II to consolidate past achievements and strengthen capacities built. In the second phase of the program, additional 61 districts drawn from the following regional states were included: Amhara, Oromiya, SNNPR, Tigray, Benishangul-Gumuz, Gambella, Harari and Dire Dawa city administration.

Objectives of the study

General objective was to characterize the farming systems of AGP-II districts and identify production constraints.

Specific objectives were:

(1) To characterizing the farming systems;
(2) To assess accessibility, affordability and utilization of improved agricultural technologies;
(3) Explore gender perspectives in extension services, and other livelihood dimensions;
(4) To identify and prioritize bottleneck of agriculture in the study area.

METHODOLOGY

The study was implemented by adopting participatory approaches actively involving the farming community.

The study area

This study focused on AGP-II districts with particular emphasis on North Shewa, West Shewa and South West Shewa zones of Oromiya Region.

Ambo Zuria is the sample district for this study. The administrative center of this district is Ambo; other towns include Gorosile and Meti. The 2007 national census reported the total population for the district was 108,406, of whom 54,186 were men and 54,220 were women. The majority of the inhabitants said they practiced Ethiopian Orthodox Tewahdo Christianity, with 51.82% of the population reporting they observed this belief, while 32% of the population practiced traditional religions, and 15.9% were Protestant.

Girar Jarso is one of the districts in the Oromia Region of Ethiopia which is the sample district for this study. Part of the North Shewa Zone, Girar Jarso is bordered on the south by Yaya Gulelena Debre Liban, on the west by Degem, and on the east by the Amhara Region. The Central Statistic Authority (2007), national census reported a total population for this district of 67,312, of whom 34,467 were men and 32,845 were women; none of its population was urban dwellers. The majority of the inhabitants said they practiced Ethiopian Orthodox Tewahdo Christianity, with 99.81% of the population reporting they observed this belief.

Data collection techniques

Blends of tools and techniques were adopted to collect the required information and dataset that addresses the objectives of the study. Mainly, two standard data collection techniques and approaches were employed in this study including desk reviews and qualitative survey techniques.

Desk review

Data was collected exhaustively from published and unpublished documents of EAIR, CSA, AGP and other governmental, non-

governmental and international partners.

Qualitative survey techniques

In the second stage, blends of qualitative survey methods (PRA tools and other participatory approaches) were adopted to collect primary information from the farming community and agricultural experts in the sample vicinity.

Using blends of participatory tools and techniques helped to triangulate the information obtained from different sources. The most important participatory tools and techniques employed included: focus group discussions, key-informant interviews, individual interviews, matrix rankings (direct and pair-wise matrix), proportional pilling techniques, diagramming, historical profiles, photographs and other relevant tools and techniques.

RESULTS AND DISCUSSION

Socio economic characteristics

West Shewa zone-Ambo district

West Shewa zone of Oromia Regional State is reported to have ago-ecological suitability for the production of different crops including teff (*Eragrostis teff*), wheat, maize, barley, faba bean and chickpea. The agro-ecology of the zone is characterized by 40% mid altitude, 27% highland and 33% low land. Among the improved crop technologies, maize accounts for the largest share (55%) followed by barley and fava bean each accounting for 10% of coverage. There is an increasing trend for teff and wheat demand. Wheat is reported to be highly susceptible to different diseases, such as yellow rust (locally named as “Wagg”) and others.

The total area of Ambo district is 78,359.69 ha out of which 74% is devoted to crop production while grazing land and settlement areas account for 11% each. The district is almost devoid of forestland and water resources each of them accounting for only 1%, while bushes and shrubs 4%.

The district has favorable climate with 15% lowland, 50% mid-highland, and 35% high land. The mean annual temperature ranges from 15 to 29°C. The district receives an annual rainfall of 800 to 1000 mm with bimodal distribution. The main rainy season (Maher) occurs from June to September and covers most parts of the district. This season is the main cropping season for different crops. It is very diverse in elevation and the altitude ranges from 1,380 to 3,030 masl.

During discussions, focus was made for such factors as wealth ranking system in the district, public services, extension service system, communication service, transportation service, income source and saving practices, climate variability, household food security, and farming dynamics.

Characterization of wealth status: As per the perception of the community, households are categorized into different wealth categories depending on agro-ecological features of AGP II districts. In the highlands, the most important wealth indicator to rural households is often ownership of livestock, especially oxen and cows. In the lowlands, food availability (food security status) was identified to be the key indicator to categorize farmers in different wealth strata. This is mainly attributed to climate change which was brought about by drought and unreliability of rainfall. In the context of highland agro-ecologies of AGP II districts, relatively well-to-do (rich) households are those who own more than 10 cattle with a pair or more of oxen for farm operations (Table 1). The farmers perceive that large livestock ownership ensures high production of grain and livestock products such as milk and butter. The implication is that such households can also afford to purchase inputs including new agricultural technologies and they are often risk takers in trying new technologies. They are food secured and their income sources are often diversified including bee-keeping, poultry and others. During demonstration of new agricultural technologies, they dare to take risks and host the experiment. Extension agents usually target these households to demonstrate new agricultural practices since they can afford to apply full packages of technologies. Even though there could be variability from location to location, such households, however, account for a very small proportion in the community, often 10% or less. In the context of lowland agro-ecologies of AGP II districts, however, well-to-do farmers are those who can produce and cover food demands of their households for nine months in a year. They adopt various practices to achieve this level of food security, such as the use of small-scale irrigation, short maturing varieties, soil and water conservation practices and others. This category of households run out of own produce and get food insecure for three months in year during which they have to take various options to make a living, such as sale of assets. Medium wealth categories in the context of highland agro-ecologies often own a pair of oxen. Apart from agricultural produce, they also strive to generate supplementary incomes through off-farm incomes (IGAs), such as petty trading. Despite not as much as well-to-do households, they make all the efforts to afford purchases of inputs, send their children to school and produce food for their family. They are not, however, food secured and economically strong as the rich wealth category. They have to strive further and enhance their economic capacity through technology use and other options of income sources. According to farmers’ estimates, this wealth category accounts for about 40% of the population in spite of variability from one location to another.

In the context of lowland agro-ecologies of AGP-II districts, medium wealth category households are defined to be those who can produce and cover food demands of their households for seven months. That means they have to run food insecure and look for other options to sustain a living for five months in a year, such as

Table 1. Characterization of wealth status of farming households in Ambo district.

Wealth category	Livestock ownership	House type	Land ownership status	Other livelihood factors	Proportion (rough estimates through proportional pilling tool)
Rich	(1) 10 or more cattle out of which 6 to 8 are cows. Produce milk throughout the year (2) Own >70 shoats (sheep and goats) (3) Own mule & horse	Corrugated roofed with painted walls	Large size of land than other categories out of which 0.25 ha is allocated to eucalyptus plantation	(1) Can afford to send children to school. (2) Own house in urban centers with TV and radio access. (3) Access to solar energy source. (4) Diversified income sources, such as bee-keeping. (5) Bank savings.	About 10%
Medium	About 6 cattle out of which about 2 are cows	Corrugated roofed with no wall painting	Own about 2 ha of land out of which 0.125 ha is allocated to eucalyptus production	(1) Engaged in off-farm IGAs, such as petty trading. (2) Can afford to send children to school. (3) Bank savings.	About 40%
Poor	Mostly no ox, but some of them can own only one.	Grass-roofed	Own 0.5 to 1 ha of land which is often leased out	(1) Mainly engage in daily labor. (2) Often affected with poor nutrition. (3) Very low economic status.	About 50%

Source: Own Survey Data (2017).

engagements in IGAs, and sale of meager assets. On the other hand, the resource poor households in the context of highland agro-ecology of AGP-II districts account for about half of the population. Most of them do not own an ox, the key farm resource. In most cases, they share or lease-out their farmlands to rich or medium wealth households. Because of this, they are food insecure and often depend on daily labor as source of their major income. The community perceives that these categories of households are not expected to adopt new technologies as they cannot afford the inputs. They are instead risk averse and hesitate from adopting new technologies and practices. Illiteracy is also perpetual in such households as they cannot afford to send their children to school. They are also vulnerable to diseases due to poor and inadequate nutrition. Given the high proportion they account in the population, focus should be given for such categories of farming households to improve their livelihoods. Households categorized as poor farmers in the context of lowland agro-ecology of AGP-II districts can produce and cover food demand of their household for only five months. This means, they have to run food insecure for seven months in a year and find a living through various options, such as looking for government supported productive safety net program (PSNP), engagement in daily labor, migration to towns and others.

Dynamics of credit service: Even though there are ranges of services being accessed for public, this study focused on assessment of the status of credit, extension, communication and transport services. Even though sources of agricultural credit can be broadly classified into institutional and non-institutional, the focus of the discussion in this report was on institutional source of credit, mainly micro finance institution, which is relatively accessible to the farmers.

A) Micro finance institutions: At the time of discussion with experts, the major sources of rural credit at the farmers' proximity are micro finance institutions, including WALQO, WASSASA, ESHET, WISDOM, VISION FUND, and BUSA-GU NOFA. In spite of availability of options of credit sources in AGP-II districts, it was estimated that agricultural credit institutions account for approximately 3% of the total rural population. However, a slightly increasing trend is being observed in recent years. For instance, the share of these financial credit institutions out of the total agricultural credit was estimated to have

increased to nearly 8% in 2017 as compared to only 5% in 2012. The implication, however, is that these institutions still have a long way to go and access large proportion of rural households.

Given the fact that about 90% of the rural population falls in the range of poor and medium wealth category, creating access to favorable credit services for these households becomes a fundamental issue that needs to be set as one of the priority agenda. This is because; it has an implication on utilization of agricultural technologies without which the growth of agriculture sector cannot be ensured on sustainable basis. While the finding of this study disclose the large proportion of resource poor and medium wealth households on the one hand, the other hand tells us that credit institutions have not yet accessed more than 90% of the farming population.

1) Challenges of agricultural credit institutions: The credit sector is trying simultaneously to meet financial requirements of the farmers. However, the following challenges were identified requiring due attention to improve efficiency and effectiveness of credit services for smallholder farmers.

(i) Insufficiency: In spite of expansion of rural credit structure, the volume of finance available for rural credit in the country is still insufficient as compared to its growing requirement arising out of increases in prices of agricultural inputs.

(ii) Inadequate amount of sanction: The amount of loan sanctioned to the farmers by the institutions is also highly inadequate for meeting their demands. Consequently, the farmers were not able to purchase packages of inputs and new technologies that help boost production and productivity. When the amount of loan sanctioned gets small in amount, the farmers get desperate and opt to spend in unproductive duties which are against the very purpose of such loan.

(iii) Censored attention for poor households: Rural credit institutions and their schemes have failed to meet the needs of the small and marginal farmers. Thus, lesser attention has been given on the credit needs of the needy farmers while comparatively well-to-do farmers are getting more attention from the credit agencies for their better credit worthiness.

(iv) Growing over dues: The problem of over dues in agricultural credit continues to be an area of concern in AGP-II districts; the recovery of agricultural advances to various institutions was not also at all satisfactory. Such growing over-dues have also resulted from poor repaying capacity of farmers. As a result, they are becoming wary of granting loan to farmers especially requesting them to form groups and make initial deposits with high interest rate and even the service charge.

(v) Less favorable conditions: It has also been reported that the pre-conditions to get credit service require less favorable for small holder farmers. For instance, the mandatory rules to access credit from the institutions include: (i) Group formation: there should be a group saving account and an individual too and a household should save about 10% of the loan for 3 to 6 months. (ii) Obliged to pay insurance, which is non-refundable. (iii) At the initial period, they should pay the first year interest rate which is estimated to be 18% of the gross loan.

(vi) Inadequate institutional coverage: In AGP-II districts, institutional credit arrangement continues to be inadequate as compared to its growing needs. The development of credit institutions indicated in the preceding sections has failed to cover the entire rural farmers of AGP-II districts who are demanding credit for agricultural input.

(vii) Red-tapism: Institutional farm credit is subjected to red-tapism. Credit institutions are still adopting cumbersome rules and formalities for advancing loan to farmers which ultimately forces them to depend more on costly non-institutional sources of credit. Thus, in order to remove limitations and problems of agricultural input credit in the district, the following suggestions were figured out after having discussions with zonal and district office of agriculture experts in AGP-II districts: (i) Close monitoring of the input credit institutions. (ii) Credit institutions should be organized in such a way to ensure efficiency and be purposeful in delivering best services in terms of rural farm input credit. Moreover, they may be transformed into multi-purpose institutions with sufficient funding capacity. (iii) Facilitators (middlemen) existing between credit agencies and farmers should be excluded.

The federal government and regional, zonal and district administrators should introduce the credit guarantee scheme so as to provide guarantee on behalf of the farmers for getting loans. The credit institutions should adopt procedural simplification for credit delivery through rationalization of their working pattern. Credit institutions should also monitor over the actual utilization of loans by developing an effective supervisory mechanism to increase productivity through adoption of technologies.

Agricultural extension service: A core focus of the government's investment in agriculture is the public extension system. In the study areas, it was reported that men have better access to extension services. Out of the 2% of the total population who have access to the extension service; 30% of them are women while 50% of them are men. Farmers' training centers (FTCs) were established to facilitate extension provision and enhance farmer-to-farmer learning. From the established 23 FTCs, 15 were reported to be functional for demonstration of agricultural technologies although they are not operating in their full capacity (Table 2). DAs and experts have technical capability and theoretical knowledge and are generally trained as specialists. In Ambo district, there exist a total of 92 DAs (about 20% females) and DA to farmer ratio was 1:12. In spite of this, it was reported

Table 2. Estimated number of FTCs and Das.

Sample	District	FTC established	FTC functional	DAs		Total DAs
				Male	Female	
District	Ambo	23	15	74	18	92
Region	Oromiya	2,549	1,147	14,511	5,143	19,654

Source: Ethiopia MOARD (2009a); Ambo Agricultural District Office (2017).

that there is little experiences of entre-preneurialism and innovations in the FTCs. Agricultural knowledge systems are defined by four core concepts including: program participation, social networks, belief-systems, and practice adoption (Hoffman, 2013; Kaivan, 2004). The knowledge system supports three learning pathways, viz., social learning, experiential learning and technical learning. This section briefly summarizes the conceptual model, and provides more details about the role of social networks. Social learning is learning that takes place through social interaction between peers and it may or may not lead to a change in attitudes and/or behavior. More specifically, to be considered social, a process must: (i) demonstrate that a change in understanding has taken place in the individuals involved; (ii) demonstrate that this change goes beyond the individual and becomes situated within wider social units or communities of practice; and (iii) occur through social interactions and processes between actors within a social network (Tewodaj et al., 2009). The government is the major provider of extension through the district offices of agriculture and rural development. These generally include such subsectors as agricultural development, natural resources, environmental protection and land administration, water supply and rural roads, input supply and cooperative promotion, marketing, and disaster management and food security. Access of smallholder farmers to agricultural technologies was observed to experience gender disparity with men still having better access compared to women and youth; this was found with training participants, field days and experience sharing service are more focused on male household head than wife and youths. For instance in Table 3, 67% of men have participated in scaling-out program of crop production technologies, while the figures were 20 and 13% for women and youth, respectively. In scaling-out program of livestock production technologies, the levels of participation were reported to be 60, 21 and 19% for men, women and youth, respectively. Overall, a large proportion of men (65%) had access to participate in various types of scaling-out programs followed by women (20%) and youth (15%). Given gender blind approach of extension service provision that has been prevalent in the past decades, involvement of women and youth in the recent extension systems could be considered as encouraging progress. In spite of participation, it was noticed that not all men, women and youth were effectively utilizing the technologies that have been promoted during scaling-out programs. For instance, out of 9,300 men who have been participating in crops extension, only 4,995 (54%) of them were reported to have utilized effectively (Table 4). In the same way, 60% of women and 83% of youths have utilized the technologies effectively. Overall, 60% of scaling-out program beneficiaries has utilized various technologies effectively (67% women, 55% men and 76% youth). The factors that attribute to effectiveness of technology utilization were identified to be wealth status, training advancement, capacity of implementation, land size, educational level and land fertility, and agro-ecological setting of the intervention area. It is inspiring to notice here that youth were observed to have utilized the technologies more effectively than men and women farmers. This might be because of their better access to education and positive attitudes towards new technologies. So intervention with youth can fill the market demand gap. The livestock based extension was focused on provision of vaccination and AI services. Farmers have been pleased with likely improvement of local cows via AI services through its effectiveness has been reported to be below the expectation. As illustrated in Figure 1, the vaccination service revealed a fluctuating trend over years mainly in response to the status of disease occurrence. For instance, vaccination service for cattle reveals a rising trend over years while others illustrate almost a stable trend on the average. In 2015, the vaccination service was high for poultry because of such diseases as Newcastle Disease (NCD), Infectious Bursal Disease (IBD) and Salmonellosis. In spite of the vaccination, however, farmers' per capita holding of chicken has decreased afterwards. Timely and effective vaccination

Table 3. Number of participants in agricultural technologies scale out programs.

Types of technologies	No. of total extension participants	Participants (%)		
		Women	Men	Youth
Crop related	13,919	20	67	13
Teff technologies	3504	14	68	18
Wheat row planting	7957	24	64	12
BBM technology	2458	17	73	10
Livestock	4354	21	60	19
Synchronization	1632	22	59	19
Artificial insemination	1487	21	60	19
Bee keeping	1235	21	60	19
Gully rehabilitation	3344	15	65	20
Total	39,890	20	65	15

Source: Ambo District Agricultural Development Office (2017).

Table 4. Participants who have effectively utilized agricultural technologies in gender groups.

Types of technologies	Technology users (%)			
	Overall average of technology users	Women	Men	Youth
Crop related	59	60	54	83
Teff technologies	42	63	38	44
Wheat row planting	63	55	60	95
BBM technology	69	82	58	133
Livestock	55	100	39	55
Synchronization	22	13	22	33
Artificial insemination	18	19	14	32
Bee keeping	79	100	71	79
Gully rehabilitation	52	42	56	50
Total	56	61	50	70

Source: Ambo District Agricultural Development Office (2017).

service is, therefore, a mandatory extension service to enhance farmers' economic status, ensure food security and nutrition, and overall livelihoods. Basic infrastructure and resources at the FTCs remain a major constraint, particularly in relation to operating funds and access to demonstration field. It was also observed that the vast majority of FTCs do not have operating equipment or inputs to pursue typical extension activities on demonstration farms. There are major "soft" skill gaps for DAs and subject matter specialists (SMSs) in the FTCs, and their ability to serve farmers is limited given a lack of practical skills for the existing and new agricultural technologies. Finally, the overall field-level system is often limited and constrained in its ability to meet farmer needs and demands. Therefore, mechanisms to make it more farmer-driven and market-oriented would yield greater results. It was also perceived that the extension service was mostly skewed to crops with very limited concern to livestock.

Taken as a whole, the following cohesive sets of actions have been suggested to strengthen the extension system in the AGP-II districts and beyond:

(1) Farming system-driven orientation: Across all levels of extension, focusing on farmer desires with need assessment at the district and PA levels is essential. The overall supervision and orientation of the extension system must be driven by farmer desires, from the types of services offered at each FTC to the overall strategic direction. A farming system-driven orientation ensures that the extension intervention is serving farmers in their areas of highest need and allows for intervention required in the agricultural system. This orientation must be balanced from bottom-up, horizontal and top-down planning to ensure food security with nutrition and environmental conservation.

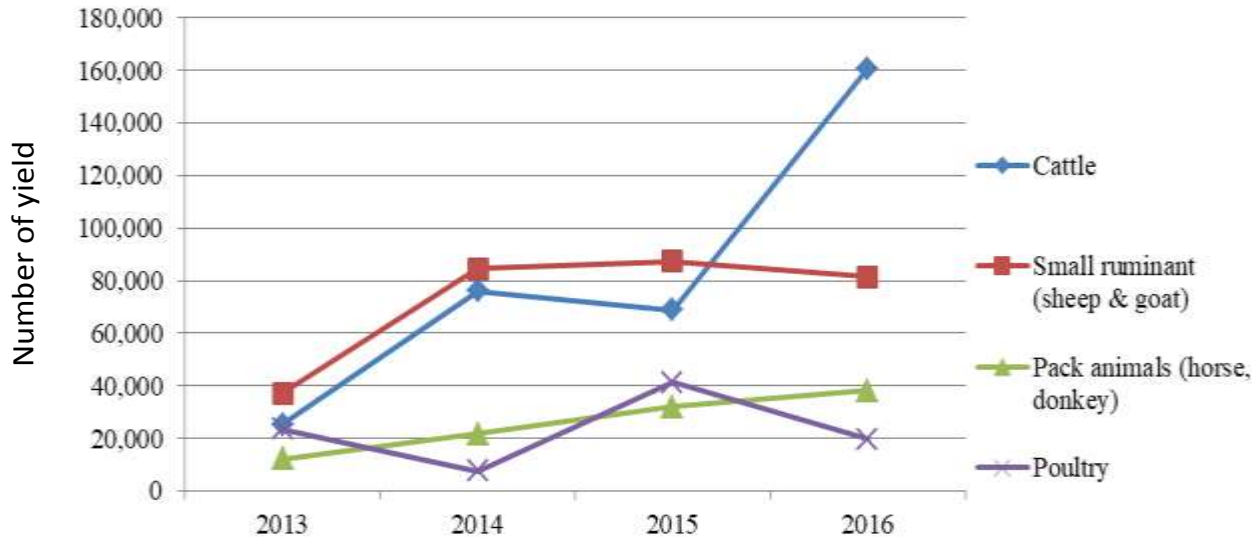

Figure 1. Animal vaccination and health extension service delivery by livestock type.

(2) Expansion of services: Extension services need to be accessible to men, women and youth in the community. Packages of technologies need to be promoted to ensure maximum benefits and sustainable impact as per the needs of beneficiaries. Knowledge and skills of all the beneficiaries need to be enhanced through various on-the-job, FTC based, experience sharing and other mechanisms. This helps to increase adoption of technology and enhance productivity.

(3) Strengthening FTCs for impact: Findings indicate that FTCs are not fully functional mainly due to lack of adequate resources, such as extension facilities. The budget allocated to FTCs is also meager to meet the demands. It has been suggested that beneficiary community need to contribute a certain amount on voluntary basis apart from strengthening FTCs to generate their own incomes from demonstration and other activities.

(4) Build and strengthen the capacities: Even though DAs are a minimum of diploma level graduates, there is a need to strengthen their knowledge and skills with practical oriented subject matters. Ranges of short-term trainings on various themes are fundamental in addition to on-the-job practical demonstrations and learning. Experience sharing to model sites could also enhance their exposure to application based interventions. It is also essential to strengthen incentive mechanisms for DAs through reward, promotions, providing opportunities for higher studies and others. Technical deliberations and professional ethics are necessary to be implemented.

(5) Strengthening stakeholder linkages: In recognition of the importance of a system wide approach to extension, the need has become evident that collaboration and linkages need to be strengthened between the key actors that have a stake in the agricultural systems. Along with office of agriculture, other actors such as research institutions, input suppliers, traders and processors, farmers, seed multiplication agencies, private crossbred heifer rearing companies and animal health providers, NGOs, higher learning institutions and others need to strengthened and maintain strong linkages through various platforms. There shall be responsibility with resource and experience sharing mechanisms, and information exchange systems among these stakeholders.

Access to communication services: Information and communication technology (ICT) can play a critical role in facilitating rapid, efficient, and cost effective knowledge management in scaling out of agricultural technologies. However, ICT application in districts with regard to rural PAs remains low in comparison to the urban setting. For instance, in a number of rural PAs, smallholder farmers get technology-related advice as well as location and farm output-specific market information on mobile telephone. Yet, due to network service problems, successful agricultural information is not delivered to farming communities as expected. So far the main method for linking different actors: farmers merely depend on traditional communication channels (like door to door) in the extension service though mobile phone has not efficient and effective contribution and other system dominant option lied on transacting door to door service . ICT can play a crucial role in benefiting the resource-strapped farming communities with up to date knowledge and information on agricultural technologies, best practices, and market price trends if it is utilized efficiently. The experiences of most districts closer to the zonal towns or urban centers indicate that rapid development of ICT, which facilitates the flow of data and information, has tremendously enhanced the knowledge

management practice in agriculture technologies as stated by the district agricultural office experts. However, currently, among the various ICT related initiatives, radio is widely used to share and inform users on agricultural issues, including new and upgraded farming techniques and production management, market information, and other issues. Due to its strategic importance in reaching the majority of the smallholders in the AGP-II districts, only few attempts are being made to strengthen the delivery of knowledge and information through this media. The way forward for ICT:

(1) Knowledge management: The agricultural sector will be achieved when the right knowledge and information is delivered to the household and other stakeholders at the right time in a user-friendly and accessible manner. To realize this, households in the farming community should be involved in the knowledge management process as knowledge generated in a participatory manner has a greater likelihood of being accepted and acted upon by the households. This will also enable the integration of traditional or tacit knowledge of farmers with the modern forms of knowledge in the research community, and further improve utilization of knowledge disseminated to smallholders.
(2) Instigating modern approaches: Agricultural system in general and the farming sub sector in particular are operating under different challenges. While recognizing that the districts have a few institutions and organizations engaged in the creation and dissemination of agricultural knowledge and information, effectiveness is inhibited by the coverage and inadequate usage of ICT. At present, radio stands out as the most utilized medium among the various ICT platforms like most districts in the nation. Men headed households have more advantages to have access to the ICT platforms as compared to women headed households in the district as stated on the key informant discussions with agricultural experts. The reason behind this was that capital accumulation is more in the hands of men to access and control over resources; so creating an opportunity for women as well is advisable.

Access to road facilities: Like many other economic and social activities that are intensive in infrastructure, the transport sector is an important component of the economy impacting on development and the welfare of the people (Rodrigue et al., 2011). When transport infrastructure is efficient, it provides various economic and social opportunities and benefits that result in positive multiplier effects such as better accessibility to markets, employment, education, health and additional investments (Oosterhaven and Knaap, 2000). Farmers have access to transportation services though the extent varies from one PA to another. For instance, in Ambo district PAs have 90% access to seasonal road and at the same time transport services despite the service cost is not determined by rationalizing distance, but rather full arbitrage type price is being set up by the vehicle owners. In Ambo district, for instance, 32 PAs have access to seasonal road while 6 PAs have no access to seasonal road and transportation facilities. This directly or indirectly affects the output marketing system for the household, and access to inputs and technologies.

Food security status: According to the data obtained from AGP-II district agricultural offices, the total cereal crop production has illustrated an increasing trend over years. For instance, in the last five years in Ambo district, cereal production has increased to 132,591,200 kg by 2015/2016 with an average productivity of 2,900 kg/ha. The total land allotted for the production of these major crops has also increased to 44,375 ha in the year 2016/2017. The district has huge head of livestock population, making a substantial contribution to the regional economy. The total livestock population size is about 158,973 cattle, 68,988 sheep, 31,533 goats, 30,517 pack animals (donkeys, horses and mules) and 92,030 poultry (CSA, 2015). In the year, 2013 to 2016 cow milk Production was about 601, 6756 L. The milk production per local cow/per day is not more than 2.5 L over lactation period of 180 days; so upgrading the dairy technologies to the hybrid cow breed potential can benefit the household and will have also an impact on market supply and inputs for processing factories. The study has also revealed that compared to the past 20 years, food shortage is becoming a common phenomenon because of such factors as population pressure in which the production growth is not in par with population increment and food demand. This problem can, however, be solved with technological interventions that can cope-up the population pressure, land infertility, climatic variability (irregular distribution of rain), and natural resource degradation, which are also reported to be the major factors that contributed to food insecurity in the AGP-II districts. Women and children are especially more vulnerable to food insecurity as their access to and control over resources (example; cash income) is limited. On the other hand; the production decision is not largely determined considering the nutrition contribution to the household. According to the information from the district agricultural office and the farmers, teff accounts for the highest share in terms of area coverage (31.2%) followed by wheat (29.5%). Therefore, there is a need to promote improved technologies for these crops so as to ensure food security of a large proportion of the population. Among the cash crops, Chick pea occupies 5.3% and lentil 3.8% of the total cultivated area indicating that increasing the productivity of these crops with improved technologies can create a possibility of cash generation for the households (Figure 2). The average yield per hectare in kg in Ambo district was 3,700.40 for maize, 3,100.70 for sorghum, 2,800 for wheat, and 2,100 for barley (Figure 3). However, the average local market

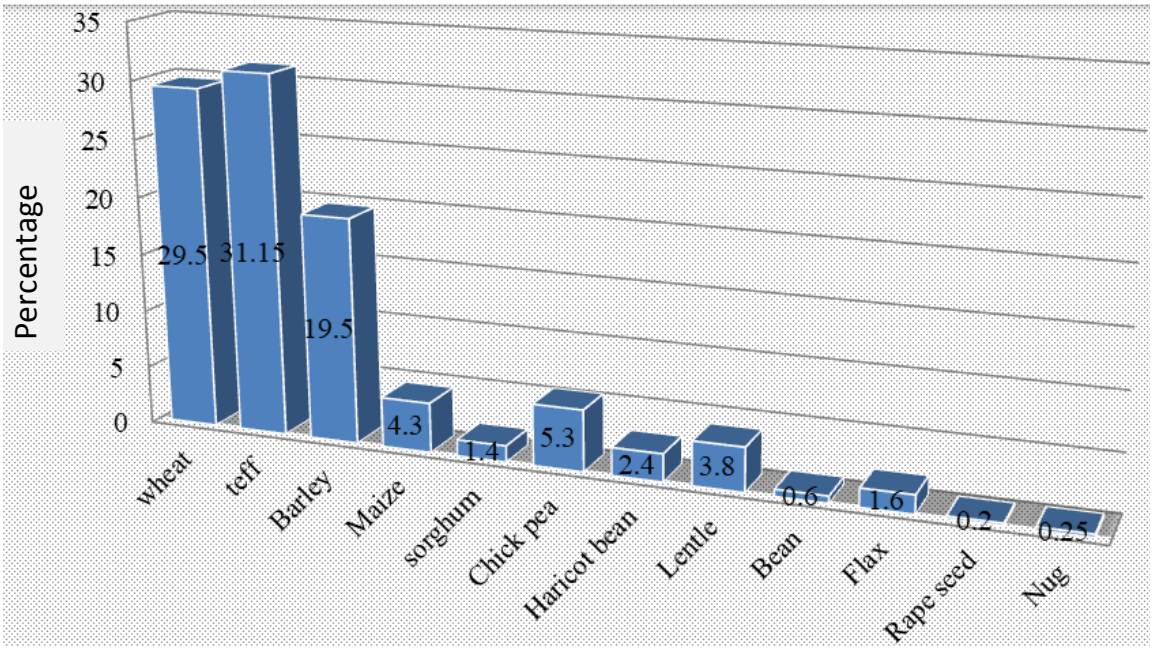

Figure 2. Percentile distribution of major crops grown in Ambo district in area coverage 2016/2017.

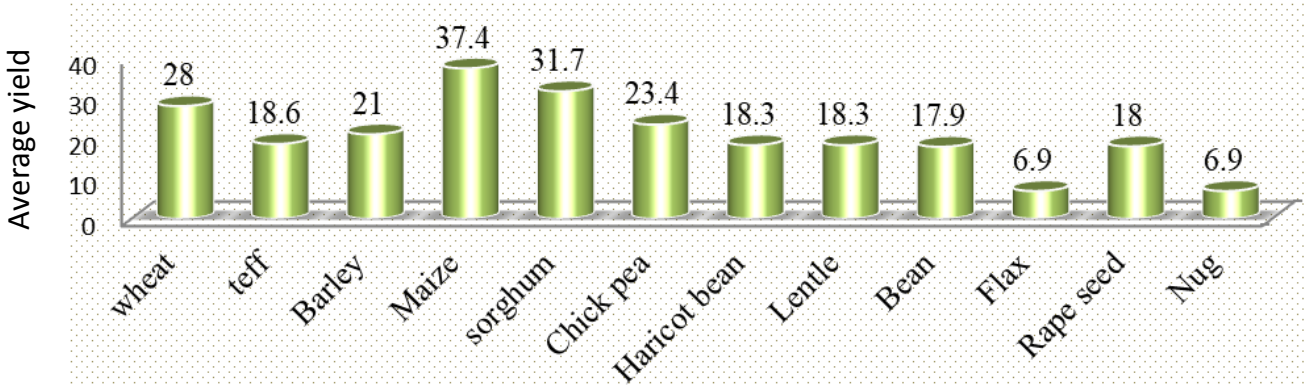

Figure 3. Average yield of crops per ha.

price for these crops varies from 6 to 8 Ethiopia birr which is closer to 0.29 to 0.38 USD (with current exchange rate of 1 USD=21 Ethiopian birr) per kg. On the other hand, the yield of teff, chick pea, and lentil was 1,800.60, 2,300.40 and 1,800.30 kg, respectively per hectare. The average local market price for three crops was estimated at 20, 24 and 21 Ethiopian birr per kg, respectively. Therefore, interventions to increase yield of these crops with agricultural technologies can have comparative advantage in enhancing farm incomes. Price advantage is a practical pricing guide for the executive or pricing practitioner who wants to identify, capture, and sustain substantial pricing gains in their output marketing. Intervention of technologies with comparative advantage in price and yield can have a high degree of probability to gain sustainable income and to attain food security, with the necessary nutritional components and economic freedom of the technology users. Food security includes both physical (that is, direct) access as well as economic access to food. It is a matter of sustainable development of communities; therefore, technology security on access and control of utilization for maximum productivity for short and long-term has to be a focal point of intervention. This approach means that the economic and social context in the wider sense needs to be taken into account, as well as the ability of households to be able to plan for, cope with and overcome future shocks. The search for long-term solutions in the fight against food shortage and under-nutrition is at the very heart of technology generation and scaling out. As the district

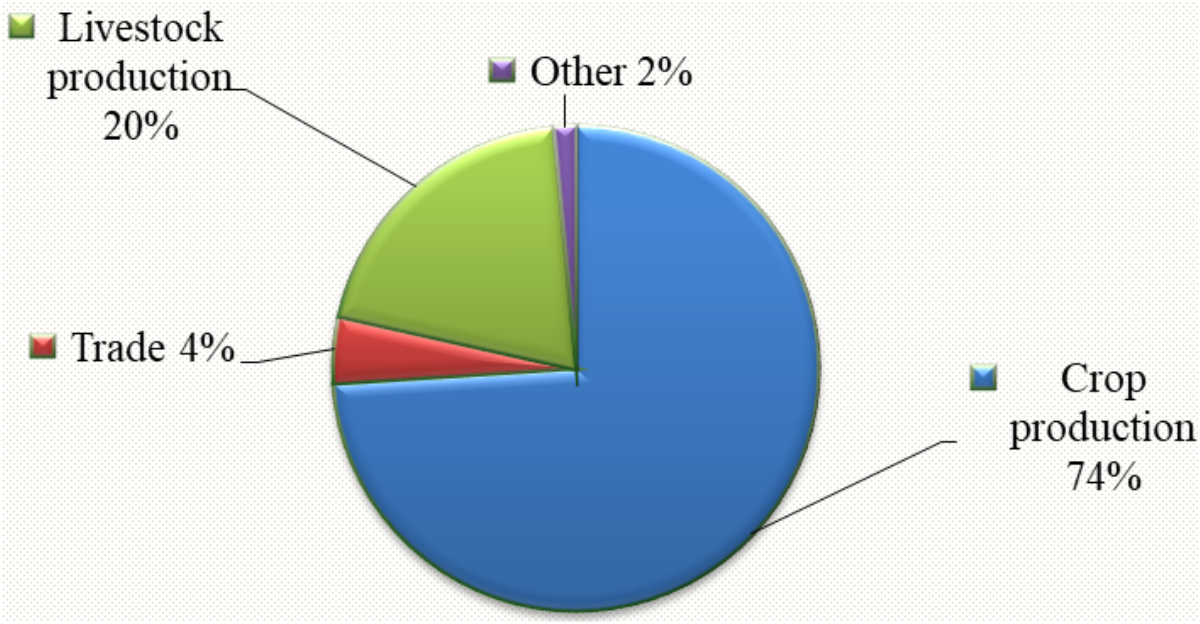

Figure 4. Livelihood base of farming households in Ambo district.

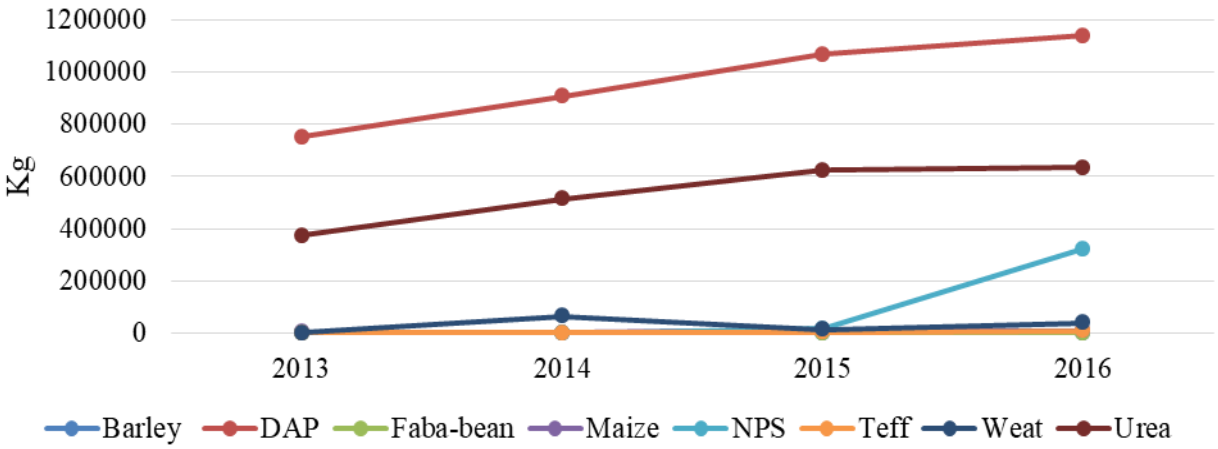

Figure 5. Use of improved agricultural input in kg 2013-2016/ 2017.

data indicates that the livelihood system of 74% of the farming community is based on crop production and 20% on livestock production (Figure 4), the necessity of an all-round approach is the core concept of poverty alleviation for ensuring food security of 94% of farming households. The use of different wheat varieties has increased by 66% from 2013 to 2016 while the amount of improved seed used in the years between 2013 and 2016 was 27,000, and 40,340 kg, respectively. Figure 5 shows the input use trends of the farmers over the last four years. The use of inorganic fertilizers, such as DAP and Urea, has shown a highly increasing trend compared to seeds of major crops.

Gender roles in farming: In the context of Ethiopian agriculture, in general, and AGP-II districts, in particular, farming activities are operated with active participation of all the household members despite there could be intra-household variability in extent of participation. The role of female farmers in crop production and management is significant, with estimated extent of 55%. For example, it was estimated that women contribute labor required for weeding, transporting, storing and managing the crop (Table 5). In women headed households, this figure definitely increases. This fact is in conformity with the study conducted in Ambo district (Ogato et al., 2007). The study has also assessed extent of participation of

Table 5. Extent of participation in crop production estimated by participatory tools.

Activity	Male	Female	Youth	
			Male	Female
Land plowing	85	0	15	0
Weeding	40	30	10	20
Harvesting	60	15	15	10
Threshing	90	5	5	0
Transporting the grain to storage	25	45	5	25

Source: Own Survey.

Table 6. Participation in livestock management farmers' judgment using proportional piling method.

Major livestock management activities	Extent of participation (%)		
	Men	Women	Youth
Housing (house preparation)	50.0	33.0	17.0
Feed collection and storage	43.0	29.0	28.0
Feeding	28.5	51.5	20.0
Watering	23.5	29.0	47.5
Health care	47.5	37.5	15.0
Cleaning	16.5	58.5	25.0
Milking	1.0	81.0	18.0
Churning	1.0	64.0	35.0
Herding	35.0	24.5	40.5
Selling milk products	0.0	71.5	28.5
Selling live animals	54.0	26.5	19.5
Mean	27.3	46.0	26.7

Source: Case of Ambo Survey.

women, men and youth in livestock production activities as illustrated in Table 6 for Ambo worda and Grar Jarso. The findings indicate that all family members are involved in livestock management related activities with varying levels of participation. For instance, during case analysis at Ambo district, estimations indicate that women alone shoulder the highest share (about 46%) of the different livestock management operations while the rest 54% of the management activities are very closely shared between men and youth (Table 6). Livestock development experts have even estimated that about 60% of the livestock management operations are performed by women. Similarly, the highest share (36.9%) of the different livestock management operations was accomplished by women followed by men (32.3%) and youth (30.8%) in the case analysis of Girar-Jarso district (Table 7). The most laborious and routine activities such as feeding, cleaning (both barn and animal), milking and churning are mainly shouldered by women, which was also attested by the district livestock production experts. Men also have considerable involvement in different livestock management activities including milking, selling milk and to some extent churning as opposed to the case at Ambo. According to the respondents, operations related to management of milk/milk products and milking animals were traditionally the responsibility of women for local cows. The role of men in managing milking cows and milk/milk products becomes more apparent with the introduction of crossbred cows in response to an increase in milk output and development of milk market (market orientation).

This shows how technological interventions and the associated improvement in productivity can change gender roles in livestock/dairy production systems. In spite of the figures, the participation of women in livestock management activities in AGP-II districts was recognized to be considerable. Most laborious and routine operations such as feeding, cleaning, milking and milk processing and fetching water over long distances for livestock managed around homesteads (pre-weaned calves, milking cows, old and sick animals) are accomplished by women. Moreover, they are required to shoulder other routine home keeping activities and various social responsibilities which triple their workload. Studies by Agajie et al. (2016) showed that men are mostly given priority to participate in different awareness

Table 7. Participation in livestock management farmers' judgment using proportional piling method.

Major livestock management activities	Extent of participation (%)		
	Men	Women	Youth
Housing (house preparation)	45.5	30.5	24.0
Feed collection and storage	43.5	29.0	27.5
Feeding	35.5	36.5	28.0
Watering	24.5	35.5	40.0
Health care	51.0	29.0	20.0
Cleaning	23.5	42.5	34.0
Milking	29.0	48.5	22.5
Churning	8.5	55.0	38.5
Herding	22.5	27.0	50.5
Selling milk	26.0	19.0	55.0
Selling milk products	8.0	72.0	20.0
Selling live animals	72.0	18.0	10.0
Mean	32.3	36.9	30.8

Source: Case of Girar Jarso Survey.

building programs such as trainings and experience sharing visits despite the fact that women are responsible to shoulder most of the livestock management operations. Such unbalanced targeting cannot lead to the anticipated improvement of the sector. Therefore, there should be fair consideration of the different family members (men, women and youth) in capacity building programs, technology demonstration and promotion on the basis of their level of involvement in the various livestock management activities. The study has also figured out gender disparities in making household level decisions. In male headed households, women have less power in making decisions on general farm operations and practices. For instance, if a woman wishes to plant some vegetable crops, it is hardly possible to implement her idea without the consent and decision of her spouse. On the other hand, women do have great job burdens whereby almost all the in house activities are the sole responsibilities of women in addition to their farm level contributions. In recent years, however, there are some indications that the greatest burden on women is tending to decrease because of men involvement in activities customarily performed by women such as fetching water, fire wood and others. Moreover, men are supportive in adopting family planning practices which help reduce child bearing thereby easing women job burdens.

Gender and agricultural technologies: Men, women and youths in a household make enormous contributions to agriculture sector. However, technology generation process in the past has largely overlooked the specific roles being played by men, women and youths. Technical skills of women, especially, are often overlooked during technology development process because of inadequate gender disaggregated information and limited skills of gender mainstreaming. It has often been perceived that women's major role in and around the house, thus classified as housekeeping and not productive. Some of the stereotypes that hamper women in their development include:

"Only male farmers can train oxen and plough with them because physical strength is needed".
"Women grow subsistence crops only so they will not be able to repay credit".

Most rural women carry a heavy workload in the district. Where women are involved in production, marketing and product processing, such duties can take up many hours a day, especially when women have complete responsibility for household in-house activities, crop production and management of animals kept near the homestead. Furthermore, most 'improvements' designed to intensify the production system, such as zero-grazing (not allowing herds to go out into pasture, but instead bringing fodder to them in a cut-and-carry feeding system) and on backyard crop (vegetable and fruit) have increased women's farming-related workloads. Rarely are these workload implications taken into account in assessing the appropriateness of new technology scaling out. T-Table was used as a tool to determine workloads of women and men in the study areas of Ambo district. As shown in Table 8, women spent 15 h a day in executing both productive and domestic (in house) activities. Out of this, they spent 27% of their time for productive (farming) activities while the remaining for domestic chores. On the other hand, men spent 11 h for productive activities. It seems that men are not involved in domestic activities because of the fact that those responsibilities are defined to be women's only roles.

Table 8. T-table workload description by gender for Ambo district (PA of Boji Gebisa and Uko Korkea).

Women		Men	
Activity type	**Time allocated**	**Activity type**	**Time allocated**
House cleaning	5:00-6:30 AM	Supply feed to the livestock	6:00-7:00 AM
Breakfast preparation	6:31-7:30	Hoeing maize in the garden, fence his house and garden	7:01-7:30
Breakfast time	7:31-8:30	Breakfast time	7:31-8:30
Milking cow, tending to livestock	8:31-9:30	Farm activities	8:31-1:00 PM
Hoeing (in farming season)	9:31-1:00 PM	-	-
Lunch time	1:01-2:00	Lunch time	1:01-2:00
Fetching water	2:01-2:30	Farming activities	2:01-4:00
Back to hoeing	2:31-5:00	Giving drinking water for ox	4:01-5:00
Preparing dinner for the household	5:01-6:00	Animal herding and hoeing the farm	5:01-6:00
Breast feed baby	6:01-6:30	Feed the ox and rests	6:01-7:00
Milking cow/Prepare coffee	6:31-7:30	-	-
Clean miscellaneous kitchen materials	7:31-8:00	-	-
Dinner time	8:01-9:00	Dinner time	8:01-9:00
Wash/Clean baby/Kid to bed	9:01-10:00	Bed time	9:01
Make ready food for tomorrow to the kids	10:01-12:00	-	-
Go to bed	6:01	-	-

Source: Own Data Computed from FGD (2017).

Northern Shewa zone-Girar Jarso

Girar Jarso district was selected for in-depth case analysis from North Shewa Zone. The National Census (2007) reported a total human population of 67,312 for Girar Jarso, of which 51% were men and 49% were women. With an estimated area of 485.32 km^2, Girar Jarso has an estimated population density of 246.6 people per square kilometer, which is greater than the zone average of 143.

From discussions with key informants and farmers group, the following problems were identified with research intervention:

(1) Crop diseases mainly of fava-bean and wheat, which are affecting the yield and productivity of the farming system in the zone. Shocks in the system can affect the poverty alleviation, food security, nutrition and other livelihood systems in the community; so solving the problem can create a positive cyclic effect.
(2) The research should intervene on soil characteristics based production system, developing varieties that can fit the soil type, nutritionally more beneficiary, suitability to stress and environmental calamities, that can fetch good market price, and considering the household labor trend.
(3) Livestock (sheep and poultry) are susceptible to diseases especially during the rainy season so intervention is required with development or innovational system that can back up the farming system for productivity increase and supply to market that even will have price stabilization. Synchronization of artificial insemination is not effective as expected to improve productivity of the dairy sub-sector mainly in rural areas where crossbred cows are scarce. So possible intervention may be required in this regard.

Characterization of wealth status: According to the perception of the community, households can be categorized into rich, medium, poor and very poor wealth status. The major indicators used for characterization included ownership of assets, such as livestock and land, food security status and other livelihood parameters as presented in subsequent sections (Table 9). Accordingly, well-to-do households are characterized to be those with adequate resources (such as about 4 pairs of oxen, about 5 ha of land) compared to medium and poor categories. The households in this category are also good beneficiaries of improved technologies and that their livelihood status is secured. It was also estimated that such a category of households roughly accounts for about 20% (Table 9). The implication is that there are at least 20% of technology users in North Shewa zone despite another 80% are still looking for improved technologies to enhance their production and productivity. The problem, however, was reported to be limited capacities to afford packages of new technologies, which is a feature of medium and poor wealth categories.

Social and economic problem analysis

Table 10 provides the cause-effect socio-economic problem analysis of women in AGP-II districts. Subsequent sections present brief description of the

Table 9. Characterization of wealth status of farming households in Girar Jarso district.

Wealth category	Livestock ownership	Technology use practices	Land ownership status	Other livelihood factors	Proportion (Rough estimates through proportional pilling tool)
Rich	(1) Own about 4 pairs of oxen, more than 4 cows some can be hybrids, more than 10 goat and sheep, will have mule, horse and donkey. (2) Experiences fattening of animals especially cattle.	Access to and high degree of improved crops and crossbred animals technology use practice	(1) Cultivate 5 ha of land. (2) Produce cash crops for income.	(1) Diversified income sources. (2) Food secured and meet nutritional needs. (3) Can afford to purchase inputs and food items, and send children to school. (4) Own additional houses in the town.	About 20%
Medium	Own a pair of oxen, 1 cow, 4 to 6 goats and sheep.	(1) Limited affordability for new technologies. (2) Mainly produce for consumption than for market	Own 1 to 2 ha of land.	(1) Food secured with limited ability of meeting nutritional demands.	About 40%

Source: Own Survey Data (2017). Ambo Agricultural District Office (2017).

Table 10. Problem analysis of women in Ambo and Girar Jarso district.

Rank	Problems	Cause	Effect	Intervention options	Opportunity	Actors
1	Limited access to hospitals	No adequate budget allocated for establishing hospitals	Morbidity and mortality rate increased	Development of health infrastructures	-	Federal, regional, zonal, and district office
2	Limited access and control over agricultural technologies (poultry, vegetable, fruit, small ruminants)	Inadequate women friendly technologies, and limited access of women to available Technologies	Limited women to generate income, development of wealth creation, nutritional attainment	Scale out the necessary technologies targeting women on income generation, wealth creation and nutritional development	There are technologies in research institutes	Research institutes, agricultural office, NGOs and research universities
3	Limited access to credit service individually for agricultural inputs	Unfavorable credit service procedures and regulations	Access denied to input purchase that cam increase productivity, poverty alleviation, food security attainment	Facilitating the credit service intervention and diversifying the intervention options	Availability of credit institutions, potential borrowers	credit institution, regional office of micro enterprise, district microfinance zonal and office, NGOs
4	Limited access to potable water	Rivers and river waters are polluted and dried	Susceptible to water born disease	Developing water point, conserving natural resources, and protecting pollution	There is ground water potential	Federal, regional, zonal, and district office
5	There are no women based cooperatives for income generation with agricultural technologies (dairy, poultry, small ruminants fattening)	There are no women friendly technologies that can initiate the cooperative system for women	Poverty, unemployed, low income for women in the agricultural system participants	Development or organizing women based cooperative with existing or to be generated new technologies	Willingness of women to involve in different cooperative for wealth creation	Research institutes, agricultural office, NGOs and research universities

Table 10. Contd.

6	Limited access to irrigable land and water points to irrigation	Inadequate plans targeted for the benefit of women and No irrigation development	Minimal utilization of technologies in annum; market participation is under exploited; opportunities to supply the demand is unutilized, poverty, food security is unattainable, nutrition is unattained	Developing irrigational development schemes	Ground water potential, irrigable rivers and streams, farmers willingness to participate for the scheme development	Federal, regional, zonal, and district office
7	No access to electric power to minimize domestic workloads	Rural electrification program not yet practical in their kebeles	Workload on domestic activities	Development on electrical power intervention	There is a developed intervention in electric power in district and zonal town	Federal, regional, zonal, and district office
8	Family planning problem	Limited access to contraceptives, social taboos on contraceptive	Birth rate increases, population pressure, limited and scarce resources over period of time, natural environmental degradation, food scarcity, poverty, conflict over resource	Creating access to contraceptive and training on the use of contraceptives to the society	Women are interested and willingness to apply contraceptive method	Women, men, youth, nurses, medical doctors, health extensions, administrative of regional, zonal and district office

Source: Own Survey Data (2017).

nature of problems and proposed intervention options.

Strategic problem of women:

(1) Limited access to hospitals: (i) As the types of illnesses change throughout the district for women, which are more than half of the population, lack of access to adequate health services was reported to be among the strategic problems facing women. A functioning health care system is crucial in ending poverty. In addition to lack of health care access, many people have chronic health issues such as malnutrition (Table 10). (ii) For any complex ailments, rural patients are referred to larger clinics. However, options for treatment or surgery can be limited because of a severe shortage of doctors and nurses in the districts. According to the World Health Organization (WHO), there were only 1,806 doctors practicing in Ethiopia (2000 to 2010), which is less than one physician for every 10,000 people. Furthermore, distance has aggravated inaccessibility issue of rural PAs located far away from district towns to health care centers. (iii) With the difficulty in accessing healthcare, many of the households in AGP-II districts use traditional healing methods and local medicines.

(2) Limited access to agricultural technologies (poultry, vegetable, fruit, small ruminants): (i) The problems of access and control to agricultural technologies have a vicious effect. It has an impact on poverty alleviation, and food and nutritional security. Poverty as a social problem is a deeply embedded wound that permeates every dimension of culture and society. It includes sustained low levels of income for members of a community. Poverty especially is one of the factors that contribute to social problems. (ii) Limited access to technologies for increased productivity aggravates the living condition that leads to absolute poverty which is associated with a minimum level of living or minimum consumption requirements of food, clothing, good structured housing (with toilets and shower), health care, etc.

(3) Limited access to credit service individually for agricultural inputs: Micro-finance institutions tend to provide group based credit services using the group itself as collateral. Since the entire group members do not have equal performance and repaying ability, those efficient farmers instead suggested that there should as well be a provision for household based credit service.

(4) Limited access to potable water: Access to

potable water is getting a night-mare for rural households. Women and children are especially more affected with the lack of potable water. They are the ones who spend a lot of time to fetch water which further exacerbates work burden of women. School children spend lots of their study time fetching water before and after schools. “I fetch water before going to school and after school also” a class 5 school girl said. The consequence of all this keeps households at higher risk of water-borne diseases and spending considerable amount of incomes for medical services.

Intervention options for women:

(1) Considering limited access to hospital and inefficient service problems, the following strategic interventions can be adopted to create healthy and productive society in the farming system: (i) Consolidate achievements in improving access to health care, construction of new health care points on the center of PAs and advancing equity deal decisively with epidemic and their ramification which threatens to undo the districts developmental gains and present and future productive labor force. (ii) Stabilize the hospital and health care sector, including the need to promote greater efficiency and adopt a multidimensional approach to ensure steady improvement in quality of health care for women. (iii) Increase access/Coverage to health care (and thus utilization). Improve service quality through training and an improved supply of necessary inputs. Strengthen management of health services at district and PAs level. Encourage participation of the private sector and NGOs by creating an enabling environment for participation, coordination and mobilization of funds to improving quality. (iv) Revitalizations of hospital services; speeding up delivery of essential packages of services through the district health system; improving resource mobilization and the management of resources without neglecting the attainment of equity in resource allocation.

(2) Limited access to agricultural technologies (poultry, vegetable, fruit, and small ruminants): The following key intervention options are required to address the problem of limited access of farmers to agricultural technologies: There are available technologies that have been developed and generated by the national agricultural research systems for poultry, vegetables, fruits and small ruminants, and others. These technologies need to be packaged, demonstrated and promoted to AGP-II districts. The first stage needs assessments to be made from each of the AGP-II districts on the type and quantities of technologies demanded; this should be followed by a program of identifying and tracking the location of the right package of technologies that can suit to agro-ecologies of the proposed districts. Along with this, there should also be intensive capacity building initiative for the beneficiaries, Das and agriculture experts. Other stakeholders across the value chain of the specific technology need also be involved to ensure sustainability.

(3) Limited access to credit service individually for agricultural inputs: To enhance access of rural credit services to the needy farming communities, it is suggested that agricultural finance needs to focus on the following areas: (i) In addition to existing group based access to rural credit, micro-finance institutions need to also create favorable conditions for access of credit services to individual households who are aspiring to get engaged in productive activities, such as fattening, dairy and others. (ii) Segment the smallholder farmers and identify their financial needs. Smallholder farmers are heterogeneous and have different needs. It is important to identify various smallholder sub-segments and assess their needs and constraints before designing solutions and products. Smallholder farmers should be advised to utilize credit for agricultural or productive activities than for other household needs or non-productive activities. (iii) Limited access to potable water: The following interventions options are suggested to address the problems associated with access to potable water; construct and install communal, tap water system in Pas, and help families keep their water safe, with awareness creation on mechanisms of drinking water management.

Strategic problems of youth:

(1) High unemployment rate: (i) Unemployment and poverty go side by side. The problem of unemployment gives rise to poverty. Young people after a long time of unemployment find the wrong way to earn money, to get rid from the unemployment stress; they adopt alcohol or drugs, finally becoming hopeless to life (Table 11). (ii) The unemployment problem in the districts has assumed alarming dimensions since twelve years back. Among the many factors that have contributed to this, some are discussed:

High population growth: The galloping increase in population has further aggravated the unemployment problem in the districts.

Insufficient rate of economic progress: The rate of growth is inadequate to absorb the entire labor force in the districts.

Absence of alternative employment opportunities other than agriculture: As other employment opportunities are not adequately available, agriculture is the principal area of employment in the district. However, agriculture could not absorb the unemployed youth due to land shortage.

Seasonal employment: Agriculture in the districts offers seasonal employment; thus, agricultural labor remains idle during the off-season.

Joint family system: Existence of joint family system in the

Table 11. Problem analysis of youth in Ambo and Girar Jerso district.

Rank	Problem	Cause	Effect	Intervention options	Opportunity	Actors
1	High unemployment rate after completion of grade 10th and at adulthood	There is no access to land, agricultural technologies, capacity building, quality of education	Poverty, lay off, stress (drinking alcohol, vagabond system development)	Creating cooperative system to using agricultural technologies or other intervention mechanisms like natural resource conservation, service development (transport), petty trade	Willingness of youth to work, availability of agricultural technologies	Youths, Agricultural research institutes, regional, zonal, district office, microfinance, NGOs, research universities.
2	Birth rate	Lay off	Poverty; as population of the household increases a per capita income decline at household level	Participating in income generation activities	Willingness of youth to participate in income generating activities	Youths, Agricultural research institutes, regional, zonal, district office, microfinance, NGOs, research universities

districts promotes disguised unemployment. Usually, the members of a family work on their family farms or do family business. There are more workers on a family farm than what would be needed resulting in labor inefficiency.

Increasing turnout of students from high school: Educated, but unemployed youth have increased due to rapid turnout of graduates from high schools and universities.

Slow development of Industries: Industrialization is not rapid in district towns and the available labor finds few job opportunities. The agricultural surplus labor force is not absorbed by the industrial sector. This leads to disguised unemployment in agriculture.

Intervention options for youth:

The following are the suggestions to solve unemployment problem for youth with wide spectrum interventions in the short and long term basis:

(1) Enhance the knowledge and skills of youths on entrepreneurships and businesses, accounting and others depending on their needs and the context of their locality. They should be encouraged to create a job of their own using favorable opportunities and resources available, and accessible to them. This can be strengthened through experience, sharing visits to model youth sectors with successful business ventures (Table 11).

(2) Strengthen availability of favorable credit services for youths to be engaged in profitable business enterprises. For instance, youths in the AGP-II districts can be engaged in cattle and small ruminant fattening, dairy production, feed processing, apiculture, fruits and vegetables and others. Depending on their interests, other opportunities can include carpentry, barberry, wood-works and other artisanship. How to engage and get successful in wholesale and retail trade sectors could also be another opportunity to which credit services are required (Table 11).

(3) More assistance to self-employed youth: Self-creativity in agriculture, trade, cottage and small scale industries, etc., should be encouraged via different provisions such as subsidy and access to land and credit. Moreover, such youth should be supported with required raw materials and skill training.

(4) Employment creation programs: Accelerate inplanning and implementing employment opportunities visa vice different theme that can even sustain long term productivity to the environment and community more importance should be given to employment. Programs like irrigation, roads, flood control, conservation, agriculture, town sanitation, and rural compost fertilizers business can provide better employment to people.

(5) Industries in co-operative sector: Industries in co-operative sector should be encouraged. This is a novel approach to fight against unemployment in rural areas near to main roads and district towns.

Cause-effect problem analysis of men has also been presented in Table 12. Economic, technological and infrastructural problems are reported to be major issues for men. Limited economic capacity has been an obstacle for men to afford purchases of inputs, such as inorganic fertilizers. Men have emphasized that they have only limited access to improved crops and livestock technologies. Clean seeds of improved crop varieties are not easily accessible in time and space. Problem related to cross-bred cows and

Table 12. Problem analysis of men in Ambo and Girar Jarso districts.

Rank	Problem	Cause	Effect	Intervention options	Opportunity	Actors
1	Unable to afford purchase of fertilizer as per recommended	Limited economic capacities of households	Low productivity, poverty, food insecurity and income generation are low because to apply the necessary fertilizer to the plot of land requires financial capacity yet price are very high	Mechanism to minimize the transportation cost; marginal profit for the cooperative suppliers can be from volume of supply as there are demands for the input; long term intervention should be geared to the development of fertilizer factories	High demand from the households	Regional, zonal, district office
2	Limited access to different improved crop varieties and improved livestock breeds	(1) Problem of availability and high price. (2) Limited economic capacity of households.	Low productivity and production, poverty, malnutrition, migration	Scale out the available technologies in volume and quality with diversified supply of technologies geared to household and gender specified interest	Availability of technologies and households interest	Agricultural research institutes, households, regional, zonal, district office, research universities, NGOs
3	Lack of mechanization of farming	Limited availability of user friendly and affordable improved farm implements for smallholders	Inefficiency and ineffectiveness for farming implements that accelerated workload, computational time,	Availing the mechanization farm implements, scale out farm technologies,	Farmers willingness to adopt the technologies, technologies availability innovated and can be imported from other corners of the world	Households, agricultural research institutes, regional, zonal, district office, importers, NGOs, microfinance
4	Inadequate access to animal health services and low efficacy of drugs	Lack of medicines with high degree of efficacy	Animal mortality rate increases, livestock productivity rate decline	Vaccination scaling out with identified method	-	-
5	Land scarcity	Population pressure	Poverty, deprivation, food insecurity can be alarmingly increasing that leads to unrest society development	Intervention on livestock with small size of land requirement (small ruminant fattening, poultry, bee keeping)	Farmers willingness to adopt technologies	-

***Solving the problem of women and youth can directly or indirectly solve the problem of men as they have their own common factors.

heifers is not only availability, but also high price which ranges from 20,000 to 40,000 Birr for a single cow or heifer. The following introduction of technologies, such as row planting and men are highly in need of associated farm implements, such as row planters; though, they could not get any (Table 12).

THE WAY FORWARD

Policy implication

To enhance farmers' livelihoods and strengthen job opportunities for the unemployed youth, government should take immediate actions to: (1) create easy access of farmers to new technologies and favorable credit services, such as minimizing the interest rate and collateral arrangement; (2) promote incentives and subsidies for agricultural technology based job creation for unemployed youth; (3) infrastructural developments like creating access to potable water in rural areas

and rural roads with transportation facilities; and (4) disseminate improved practices and technologies for the farmers to process output into products having higher added values.

Other issues of focus that should be considered include improving the spatial land arrangement, promoting proper land management, introducing intensification programs to elevate land productivity, and developing reliable environmental monitoring system, especially to detect extreme conditions of the climate variability glitches.

Can value chains be made pro-poor?

That really depends on definition of 'poor'. It is clear that modern extension service value chains are not an answer for the poorest. People who are not already actively involved in producing for sale are unlikely to meet the requirements of commercial chains. They may be too far away from major roads, have too little land, and have insufficient education to be able to appreciate the requirements of buyers and have limited or no financial resources to upgrade production in the existing farming system that the value chain demands or market driven production quality or quantity.

How can poor be included in value chains?

Extension service value chains are not charities. If they are to be sustainable farmers, they must be profitable comparing the cost benefit ration from implementing new technologies and market supply. Their decision about the farmers to work with must be based on farmers' capacity and interest of commercial criteria. So, including the very poor in chains requires government support. This should involve start up engine subsidizing with technologies and full training packages that can enhance capability of farmers to solve the existing and future demand which starts from bottom up and upgrading their commercial viability. Improving education, providing greater access to extension services and better infrastructure, particularly roads can over time make poorer farmers more attractive to commercial points. Guaranteeing an environment in which rural businesses can succeed is also essential; such as input suppliers will not want to work in rural areas if there is corruption or too much bureaucracy.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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