

Transformation in Smallholder Agriculture through Intensification in Ethiopia: Determinants and Implications

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It is a challenge for a farmer with limited resources to decide on the production of commodities and investment in the farm. Transformation of smallholder subsistence agriculture, to market oriented value addition based agriculture is vital for poverty reduction in Ethiopia. This study was initiated to explore the factors which contribute for the adoption of improved wheat and pepper varieties and intensification of the farm in Bure district, Ethiopia. The study took a random sample of 200 households using two stage sampling procedure with a probability proportional to size technique. Descriptive statistics and econometric statistical tools were used for analyzing the data and answering research questions. Different demographic, social, economic and access to institutional support service variables which are theoretically supported to influence the adoption and use of improved technologies and intensification of the farm were used for the logit and multiple linear regression model respectively. Resource endowments of the farm household, institutional factors and socio-economic factors are found to be vital in the decision making for intensification and adoption of improved varieties. It is found that different institutional support services in the rural economy have had significant role to enhance the uptake of technologies and intensification of smallholder agriculture. [H. Yesigat. Transformation in smallholder agriculture through intensification in Ethiopia: determinants and implications. International Journal of Agricultural Science, Research and Technology, 2012; 2(3):123-128].

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Abstract

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1. Introduction

In policy dialogues and development policy discussions, transformation of smallholder agriculture to market oriented production system is agreed to be a solution for the prevailing problems of poverty and food security in the rural Ethiopia (Habtamu, 2012). Even though agriculture has been the main stay of Ethiopia's economy for centuries, it has remained less efficient owing to old and traditional means and practices of farming on the one hand and the poor socio-economic circumstance on the other (Mengistu, 2000).

The rate of agricultural growth in the country depends on the rate of transformation of the small scale and subsistence agricultural sector to market led production system (Habtamu, 2012). Agricultural extension service is of the many institutional support services that could play a critical role in the transformation process. It is believed to contribute to the uptake of new and improved technologies by farmers through the improvement of access to information (Berhanu et al., 2006).

Extension services in Ethiopia were focused on increasing production and productivity in view of achieving food security. Creating a functional link between the geographically dispersed small scale farmers and the market remains a challenge of the development process. Ethiopia has recently started to

emphasize the transformation of subsistence agriculture into market orientation as a basis for long term development (Berhanu et al., 2006). The average productivity of farms and farmers in the country is not as to the potential productivity of technologies released in research institutions (Habtamu, 2012). This in the one hand reveals low rate of technological adoption in the country and in the other hand assures the possibility of enhanced productivity and production even with the existing technologies.

Market orientation as an approach has been implemented in the country to enhance the uptake of technologies by small-scale farmers and improve their benefit (Moti et al, 2009). Knowing the institutional, demographic and socio-economic variables which influence the decision of the household for intensification could have practical importance for future attempts in market orientation and commercialization of Ethiopian agriculture.

2. Conceptual Framework

The majority of small-scale farmers in the Imperial regime in Ethiopia were not using modern agricultural technologies and inputs till Integrated Rural Development (IRD) projects evolve with the assistance of donors. Command economy based input

provision service was in place in the Derg¹ regime and only government managed farms were known for using modern agricultural technologies (Demisse, 2006). The missed functional link to the market has obliged the farmers to pay for the adverse market condition despite the fact that productivity gains are promising. Market orientation and linking production decisions to the market signals is a way out from the prevailing problems (EPRDF, 2001; Habtamu, 2012).

The key strategy to realize poverty reduction objective in rural Ethiopia is transforming subsistence agriculture into market orientated agriculture. This transformation requires making improved technologies available, accessible and affordable to farmers which is believed to come through improving the institutional infrastructure and support services to farmers in addition to others. In this transformation process, realization of a functional link of farmers to the input and output market has strategic importance. The complex farming system has to be well explored and the factors contributing for the investment decisions of smallholder farm households have to be known. It is vital to know the factors which contribute to the adoption of technologies at a small farm household level.

The factors which contribute to sustainable uptake of technologies and intensification of the farm are always the questions which limit the well functioning of the system. On the one hand the contributing factors are different with different farming practices, farmers' problems and agro-ecologies and on the other hand, the institutions and socio-economic circumstances functional in different areas are different. There is a knowledge gap that needs to be addressed here and the outcomes of this study have practical importance to devise the agricultural extension system in the country.

3. Materials and methods

Sampling Method and Data Collection

Secondary data and primary data were the sources for information in the study. Primary data were generated through formal and informal surveys in the study area. The informal survey was done to identify variables to be focused on during the formal survey and information required to design a formal survey. In addition, informal discussions were held with the district experts and development workers of the peasant associations in the sample and focus group discussion with farmers were held for further understanding of the issue.

A two stage sampling procedure was implemented for the collection of data. Four peasant associations were selected in random basis from the

district. Using probability proportional to size technique (based on the proportion of number of households in each kebele to the total households in the four kebeles as a base for determining the sample), a total of 200 farmers were included for the formal survey. The data were collected from January 25 to February 25, 2010 using pretested structured questionnaires.

Table 1. Sample size

Sample	Total	Sample	
		Number	%
Arbisi	703	34	17
Wondgi	1114	56	28
Wangedam	1499	74	37
Wadra	729	36	18
Total	4045	200	100

Source: Survey data, 2010

Data analysis

Descriptive statistical techniques were employed for the purpose of describing the demographic and socio-economic structure of sample households in the study area. The logit and multiple linear regression models are used for evaluating the contribution of different demographic, socio-economic and institutional variables in the adoption and use of input and intensification of farm households respectively by taking two major marketable commodities in the area. The dependent variables in the model are adoption of improved wheat/pepper varieties and input use per hectare.

Ordinary Least Squares (OLS) is used to determine the relationship of coefficients with the dependent variable in the case of input use. However, adoption is a discrete variable in the study (a household will be an adopter of a variety or not) and OLS is impractical for the purpose under consideration. In this case, the probabilistic distribution in worthwhile, and the logit model is used to see the influence of variables on the dependent variable.

Variance Inflation Factor (VIF) and Contingency Coefficient techniques were employed for checking the occurrence of multicollinearity in the model for continuous and discrete variables (Gujarati, 2004). Robust standard error estimates were used to take into account of the intra-cluster correlation (Huber, 1997).

1- Military and Socialist government

4. Results and discussion

4.1 Results

4.1.1 Descriptive Analyses Results

The descriptive results of the age structure of the sample households show that the average age of household heads in the sample was 44 years. The average age imply that most of the farmers included for the study have had adequate farming experience. The average family size of the farmers in the sample is 6.1 which is used as a proxy for the labor availability of the household. The sample composed of 160 male headed and 40 female headed households. 41% of the sample household heads attended formal education while the rest 60% are illiterate (Table 2).

4.1.2 Econometric estimation results

Adoption of improved seeds

An access for credit in the study is found to significantly affect the adoption of wheat varieties. Farmers with an access to institutional credit are better in adoption of improved wheat varieties than those who have no access for institutional credit (at 1% probability level).

Literacy of the household has positively and significantly affected the adoption of improved wheat varieties of the household. Adoption of a new variety is not simply easy decision and has associated risk for the farmer. Literacy improves their trust to technology, enhances their knowledge through different Medias and of finally the risk taking potential (Table 3).

The ownership in livestock measured in TLU has significantly affected the probability of adoption of the household for improved pepper varieties. The access to credit provision by micro finance institutions and cooperatives is found to play a vital role for the adoption of improved pepper varieties (Table 4).

Intensification and input use

The major source of labor for cultivation of crops in the study area is family labor supplemented sometimes by hired and casual labor. In times of weeding and harvesting, it is reported that hired labor and collective labor is frequently used. All of the farmers that grow wheat apply fertilizer and/or compost in their farm even though the rate is different from the recommended rate to the area. It is partly due to the high cost of fertilizer and other wise, the difference in the fertility of the soil in different farms.

Oxen are vital as a source of draft power for agricultural practices in the study area. There is an experience that the farm households can rent in oxen in case the household has no oxen. As the number of oxen increases by one, the expenditure for input in

per hectare of wheat farm decreases by about 57 birr. The negative relationship between these variables is explained by the reduction in the cost for rent of oxen for an increased ownership in oxen. Livestock ownership has a positive and significant relationship with expenditure for input per hectare of wheat farm.

The decision in allocation of land for a type of crop is not simple as a response that risk is pervasive in the area and diversification is sometimes used as a risk copying mechanism at the household level. Land allocation for wheat is found to be influential on the decision to invest in the farm. As the size of the farm allocated for wheat increases by one hectare, the expenditure for wheat farm per hectare increase by 239 birr (at 1% probability level).

Farmers from the focus group discussion agreed that most farmers in the area have had liquidity problem to afford for input. Credit access is found to be vital for the investment in wheat farm. Access to credit of the farm household enhances the investment in a wheat farm per hectare by about 108 birr.

Of the commercial crops produced merely for the market, pepper took the lion's share in the study area. This is as a response for the rising market price of pepper in a rate faster than any of the crops in the farming system. According to the discussion with the farmers, this crop is susceptible for insects, pests and disease and farmers in many cases fail to get a harvest. For the purpose, farmers frequently apply different IPM (Integrated Pest Management) tools and chemicals.

About 35% of the respondents didn't allocate land for pepper production and this in one way or another is related to shortage of land. When the land allocated for pepper production increases by 1 hectare, the investment per hectare of land increase by about 375 birr (at 1% probability level).

Small scale farmers are predominantly dependent on the government extension system for the source of improved seed and fertilizer. Farmers should go to the district town to access information, improved seeds and fertilizer and to sell the produce. As the time to reach to the main town in the district increase by one hour, the investment for pepper production per hectare of land will decrease by 52 birr. In the same way, access to credit service enhances the expenditure of the household per hectare by 105 birr (at 5% probability level).

Table 2. Descriptive statistics of sample households on pre-intervention characteristics

Explanatory Variable	Observations	Total Sample HHs			
		Mean	STD	Min	Max
Age	200	44.03	11.97	20	75
Number of oxen	200	2.12	1.44	0	8
Livestock in TLU	200	5.85	4.16	0.13	26.8
Family size	200	6.10	1.99	2	12
Land size	200	1.33	0.94	0	6
Time to reach to the development center	200	0.44	0.35	0.01	3
Time to reach to the woreda town	200	1.70	0.90	0.2	4
Land allocated for wheat	200	0.44	0.55	0	5
Land allocated for pepper	200	0.21	0.19	0	1

Table 3. Logit estimation for adoption of improved wheat varieties

Variables	Coefficient	Robust S.E	Z value	P
Age	-0.00	0.01	-0.09	0.65
Sex	0.42	0.40	1.05	0.32
Number of oxen	0.41	0.26	1.57	0.10
Livestock in TLU	0.13	0.08	1.63	0.09
Family size	-0.22	0.24	-0.91	0.79
Literacy of the head	0.42	0.16	2.63***	0.01
Land	0.07	0.24	0.29	0.87
Land allocated for wheat	0.97	0.57	1.70	0.09
Time to reach to the development center	-0.87	0.50	-1.74	0.08
Time to reach to the nearby town	-0.49	0.34	-1.44	0.15
Access for credit	1.69	0.34	4.97***	0.00
Constant	-0.55	0.85	-0.65	0.52
N	200			

*** means statistically significant at 1% probability level

Table 4. Logit estimates of adoption of improved pepper varieties

Variables	Coefficient	Robust S.E	Z value	P
Age	0.01	0.01	1.00	0.29
Sex	-0.49	0.51	0.96	0.34
Number of oxen	0.30	0.31	0.97	0.32
Livestock in TLU	0.27	0.13	2.08**	0.03
Family size	-0.03	0.19	-0.15	0.87
Literacy of the head	0.06	0.21	0.29	0.77
Land	0.47	0.27	1.74	0.09
Land allocated for wheat	2.27	1.27	1.79	0.07
Time to reach to the development center	-0.19	0.57	-0.33	0.73
Time to reach to the nearby town	-0.04	0.24	-0.17	0.87
Access for credit	0.97	0.43	2.25**	0.02
Constant	-0.97	1.22	0.79	0.45
N	165			

** means statistically significant at 5% probability levels

Table 5. Linear regression estimates of expenditure in input per hectare per wheat

Variables	Coefficient	Robust S.E	T value	P
Age	0.68	1.29	0.52	0.60
Sex	26.38	35.96	0.73	0.46
Number of oxen	-57.22	21.41	-2.67**	0.02
Livestock in TLU	15.19	6.79	2.23**	0.03
Family size	9.37	12.61	0.74	0.46
Literacy of the head	7.61	13.71	0.56	0.58
Land	36.99	27.08	1.37	0.28
Land allocated for wheat	238.90	35.83	6.67	0.00
Time to reach to the development center	-61.16	41.97	-1.62	0.11
Time to reach to the nearby town	-17.61	18.25	-0.96	0.34
Access for credit	107.68	29.05	3.71***	0.00
Constant	118.67	74.33	1.59	0.11
N				

** and*** means statistically significant at 5 and 1% probability levels

Table 6: Multiple linear regression estimates of expenditure for input in pepper

Variables	Coefficient	Robust S.E	T value	P
Age	2.43	2.09	1.16	0.25
Sex	-7.93	58.42	-0.14	0.89
Number of oxen	-22.24	32.78	-0.68	0.49
Livestock in TLU	2.06	11.07	0.19	0.85
Family size	-19.91	20.54	-0.97	0.33
Literacy of the head	26.41	22.28	1.19	0.24
Land	29.19	32.03	0.91	0.36
Land allocated for wheat	374.95	130.74	2.87***	0.00
Time to reach to the development center	-52.53	68.07	0.77	0.44
Time to reach to the nearby town	48.54	24.39	1.99**	0.04
Access for credit	104.99	49.59	2.12**	0.03
Constant	248.22	159.77	1.55	0.19
N				

Source: Own estimation result

** and*** means statistically significant at 5 and 1% probability levels.

4.2 Discussions

The agricultural development strategy of the country emphasizes on the importance of education and capacity building of small-scale farmers to achieve rapid economic growth and progress in poverty reduction (EPRDF, 2001). As to the premises, the study result revealed that education improves the probability of adoption of improved varieties of the household. The result is in line with the findings of the work done by Berhanu *et al.* (2006) in evaluation of the extension system and commercialization agriculture in Ethiopia. The public has been investing in different forms of technology extension including training and experience sharing visits and these attempts will be successful if there is improvement in the human capital of the farmers.

Credit is considered to be vital to adopt technologies in developing countries where farmers in most cases are ill-afford to pay for the cost of input. Unless there are financial institutions which can improve the liquidity of the farm through credit provision, attempts to improve input use and improved varieties rather be impractical. The Ethiopian government devises different strategies and established joint micro-financial institutions to improve the access and availability of credit (EPRDF, 2001). In many studies in Ethiopia, credit access and availability is found critical factor on the intensification of the farm adoption of improved varieties (Berhanu *et al.*, 2006; Lema *et al.*, 2012).

Livestock are the basic assets in the smallholder agriculture for many advantages ranging from being sources of meat, draft power, manure, hides and skin e.t.c to asset accumulation and risk coping strategy. Livestock and oxen ownership of the household found an important factor which influence the intensification and input use of the farm. Berhanu *et al.* (2009) found the same result in their work on institutional service delivery in agriculture. Livestock are of the relatively liquid assets of farmers and the

ownership of assets has clear association with the decision of farmers on purchased input use (Habtamu, 2012).

Land is a public property right in which the government has exclusive control and farmers have a use right on the farm. Land markets are not well functioning well and the landholding of the household is vital for farming. In the study, landholding of the household affected the decision of the households to intensify their farm. Studies in Ethiopia have found the importance of land holding on adoption of improved varieties and intensification of the farm (Habtamu, 2012, Lema *et al.*, 2012). Maffioli *et al.* (2008) also found the same result in Argentina on his work on the impact of extension system in fruit farming. However, Berhanu *et al.* (2009) has found that small farm size doesn't have a negative implication on input use and market orientation.

The nearby town is a source of information and place of input and output market for smallholder farmers. Road and other infrastructures improve the closeness of the farm household to information which helps to improve decisions in the farm. It is found that those close to the nearby town have better probability of adoption of improved varieties and input use to intensify the farm. This result is similar to the works of Berhanu *et al.* (2009) and Yibeltal (2008).

5. Conclusions and Recommendations

Farmers in the area in most cases ill-afford to pay for all the costs vital for agricultural production. Wheat and pepper varietal adoption is found to be a function of the access of institutional credit of the household. It is suggested that credit should be made available to the farmers in line with the technological provision.

Distance to the nearest extension service delivery office is found to affect the adoption of

improved wheat varieties. Distance to the district town affects the expenditure for input of pepper production. It is vital to work for the provision of door to door extension service for all households on the one hand and to monitor the extension agents to reach to all the clients. Infrastructure development is vital to link the farmers to agricultural, input and output market.

The flexibility of decision in the farm household can be resulted from enhanced income or institutional arrangements (cooperatives) and demographic variables. The socio-economic variables reflecting the asset of the household (livestock ownership and land holding) and literacy are found to affect the decision of the farm household. In an attempt to commercialize agriculture in the household, resource has to be considered important. Less than half of the heads of households get formal education and it should be focused to deliver and enhance the provision of education in rural Ethiopia.

As the farm household decides to allocate bigger area for a crop, the possibility of adoption of improved varieties will enhance. Specialization can be considered vital here and it can be seen as a way to enhance the adoption of improved varieties and expenditure of the household for agriculture.

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