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Determinants of non-farm livelihood diversification: evidence from rainfed-dependent smallholder farmers in northcentral Ethiopia (*Woleka* sub-basin)

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ABSTRACT

Diversifying the sources of livelihood for subsistence farmers beyond agriculture plays a significant role in reducing poverty as well as withstanding the adverse impacts of climate change. A cross-sectional survey research design has been employed to examine the factors which determine the participation of rainfed-dependent smallholder farmers in non-farm activities using a mixed methods approach. Data were obtained from 384 randomly selected households in the *Woleka* sub-basin of Ethiopia. Data were collected using survey questionnaires and interviews were analyzed using mean, percentage, chi-square test, t-test, one-way ANOVA, binary logistic regression model and thematic analysis. Access to adequate capital, poor infrastructure and lack of training are the major constraints which hindered farmers from undertaking non-farm activities. The regression model result revealed that several factors determine the propensity of smallholder farmers' participation to non-farm activities. Better-off households, households led by literate and younger heads, having access to microfinance, having extension services, and having social responsibilities create engagement in non-farm economic activities. We argue that strengthening agricultural extension services, providing microfinance, entrepreneurial training and skill development, and infrastructure development would enhance the participation of smallholder farmers in non-farm activities. To achieve this, policy makers and other stakeholders need to integrate non-farm livelihood strategies into rural farming economies.

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livelihood diversification;
binary logistic regression;
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1. Introduction

Climate change has increased uncertainty and risk, predominantly in the farming sector. As a result, strengthening the resilience and adaptive capacity of smallholder farmers are necessary so as to cope with this additional threat. In this regard, livelihood diversification is a key rural household survival strategy and plays a considerable role in reducing vulnerability to climate change effects and is among the possible adaptation options for adverse impacts. Engagement in non-farm activities, besides its contribution in absorbing rural surplus labor could enable to reduce income uncertainties, increasing agricultural productivity and could also be among the plausible adaptation strategies to climate change (Yaro 2013; IPCC 2014). In the past, as described by Lanjouw and Lanjouw (2001), the rural non-farm sector had been considered as a low-productivity sector which produces low-quality goods and was often expected to diminish as a country develops. However, a shift away from this position towards appreciation of the role of

rural non-farm sectors in their contribution to economic growth, rural employment, poverty reduction, sustainable natural resource management, climate change adaptation strategy and a more spatially balanced population distribution have been developed recently. In one of its report, the World Bank gave its testimony that millions of rural people worldwide have enabled to leapfrog from poverty through better incomes and employment in rural non-farm enterprises and hence contributed to better livelihood (World Bank 2008). Since rural non-farm economies are mostly small-scale, require low entry capital, and its seasonality and amenability are suitable to home-based activity; they can play an important role in the economic transformation of developing countries and as a viable adaptation strategy to climate change-induced shocks (Haggblade, Hazel, and Reardon 2007). Empirical findings evidenced that, those engaged in non-farm livelihood activities are more likely to meet the basic need of their family, are more capable of withstanding shocks and having a

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more stable livelihood than those that have to farm as a single source of their income (Leary and Kulkarni 2007; Mwamba 2013; Seng 2015). A study by Ersado (2003) in Zimbabwe and by Mwamba (2013) in Kenya confirmed that households with a more diversified income portfolio were better able to withstand the unfavorable impacts of the policy changes and weather shocks. A study in rural Cambodia by Seng (2015) also confirmed positive gains for farm households in per capita food consumption due to their engagement in nonfarm activities.

Multiple motives (*push* factors and the *pull* factors) prompt households and individuals to diversify assets, incomes and activities. While some diversify because they have little choice, better-off households may diversify because they have a lot of choices (Ellis 2000; Barrett, Reardon, and Webb 2001). Diversification may occur either as a deliberate household strategy or as an involuntary response to the crisis; it can act both as a safety valve for the rural poor (survival) and as a means of accumulation for the rural rich (Ellis 1998; Adi 2007). Likewise, the reasons behind diversification as a livelihood strategy, according to Ellis (2000), are often divided into two principal considerations: necessity (involuntary and desperation reasons) or choice (voluntary and proactive reasons).

While reliance on non-farm income diversification is widespread in rural Africa, not all households enjoy equal access to attractive non-farm opportunities (Barrett, Reardon, and Webb 2001). Farm household diversification into non-farm activities emerges, according to Barrett, Reardon, and Webb (2001), from time-varying or diminishing returns to labor, market failures, as *ex-ante* risk management, and from *ex-post* coping with adverse shocks. Davis (2003) and Haggblade (2007) have categorized the driving factors behind diversification as demand-pull (like new market or

technological opportunities) and distress-push (like lack opportunities, shocks, small land size, poor land quality and crop failures) factors. The combined relevance of push and pull factors suggests that there are two sets of non-farm activities: those who serve as last resort activities for the poor, and those that provide profitable opportunities for those who have access (Atamanov 2011).

As stressed by Ellis (1998), the basic issue to be addressed in any analysis of livelihood is what combination of livelihood resources result in the ability to follow what combination of livelihood strategies with what outcomes are given a particular context. Members of a household combine their capabilities, skills and knowledge with different resources at their disposal to create activities that will enable them to achieve the best possible livelihood for themselves including non-farm economic activities (see Figure 1). In asset-based frameworks, capitals are usually allocated across six categories and livelihood outcomes are the achievements of livelihood strategies, such as more income, increased well-being, reduced vulnerability, improved food security and a more sustainable use of natural resources (Ellis 1998; DFID 1999). Diversification of livelihoods both on the farm and non-farm is among the major policy areas for building resilience to climate change and reducing vulnerability (Yaro 2013; IPCC 2014). Smallholder rainfed-dependent subsistence farmers are considered to be the most vulnerable to climate variability and change and need interventions to adapt their livelihood systems to changing climatic conditions (NMA 2007). With erratic rainfall, recurrent drought, limited participation in non-farm activities and widespread natural resource degradation in the study area, it could be very difficult for the smallholder farmers to overcome the adverse impacts of climate

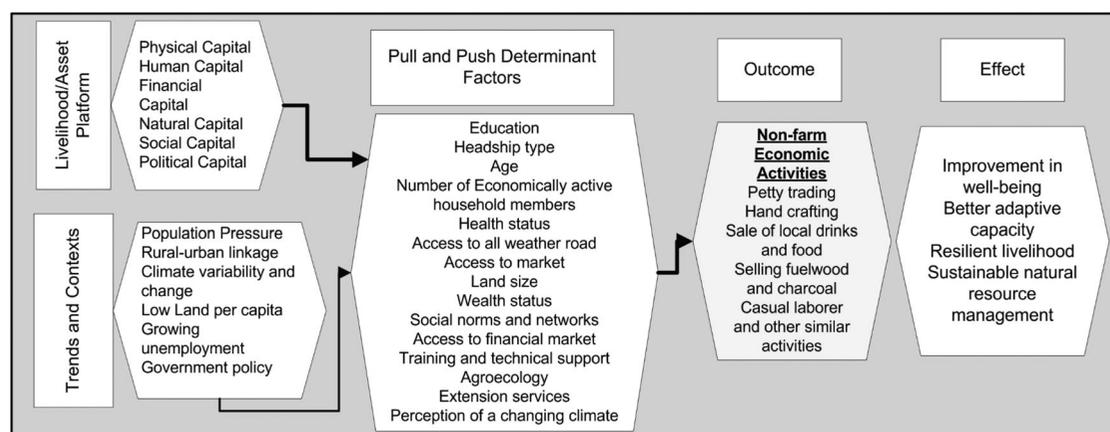


Figure 1. Determinants of non-farm economic activities: conceptual framework. Sources: Adopted from Ellis (1998), DFID (1999) and Barrett, Reardon, and Webb (2001).

change and requires immediate interventions. Climate change and variability have become as one of the major threats and will further exacerbate the existing problems in the study area, and would probably further increase the vulnerability of rainfed-dependent smallholder farmers. Relief aid and safety net programs, which are being carried out by the government and non-governmental organizations (NGOs) in the study area, might contribute to saving life in times of famine but might not be a long-lasting solution to adapt the changing climate. Mintewab et al. (2010) on their part disclosed that growing foreseeable weather uncertainty would probably affect particularly the agricultural economy. As a result, understanding alternative and accessible coping mechanisms that enable the smoothing out of incomes and consumption by complementing varying sources of income is fundamental. In this regard, designing feasible and sustainable adaptation strategies, and diversifying the livelihood of the smallholder farmers besides agriculture could have a paramount contribution to enhancing their resilience capacity to climate change-induced impacts (Barrett, Reardon, and Webb 2001).

A study by Temesgen, Ringler, and Hassan (2010), in the Blue Nile basin, found that smallholder farmers who have a non-farm source of income were less likely to depend on food aid and liquidating their assets in times of climate-induced shocks. Though empirical findings have underlined the importance of non-farm livelihoods, very small proportion of farmers in Ethiopia has access to non-farm income (Temesgen, Hassan, and Ringler 2008). A study by World Bank (2010, 84) found that income diversification as an adaptation strategy to climate change was not common in Ethiopia. Rijkers, Söderbom, and Teal (2008) particularly disclosed that only 25% of rural households in Ethiopia had one or more sources of income from non-farm activities and only 2% of all households relied exclusively on non-farm enterprise activities. According to this report, the participation of rural households in non-farm economic activities was among the lowest in Amhara National Regional State (ANRS) where this study is conducted. A similar result was disclosed by Bazezew, Bewket, and Nicolau (2013) in drought-prone areas of ANRS. Furthermore, a study by Bantider, Hurni, and Zeleke (2011) in the eastern escarpment of Wollo (Ethiopia) has reported that, though there is a scarcity of cultivated land and majority of farming households were destitute, livelihood diversification into non-farm activities was found to be low.

Even though expansion of non-farm income generating activities has been designed among the key intervention for moisture deficit areas during the growth and transformation period in Ethiopia (MoFED 2010, 53), they are not well developed and practiced in the study

area. The limited availability of non-farm employment opportunities would make the effort of households in securing viable livelihoods that are resilient to climate change-induced vulnerability more difficult. Knowing the existing livelihood strategies and pointing out the determinant factors affecting smallholder farmers in practicing non-farm sources of livelihood is unquestionably important in the provision of information to formulate an appropriate strategy for the development of the sector. The major determinate factors inhibiting smallholder farmers to engage non-farm livelihood activities have not been studied adequately and empirical studies on this issue are limited in the study area. Therefore, the intent of this study was to identify the socioeconomic and institutional factors which determine the decision of smallholder farmers' participation in non-farm activities.

2. Methods and materials

2.1. Description of the study area

2.1.1. Location and biophysical situation of the sub-basin

Woleka sub-basin (in the North central part of Ethiopia) covers an estimated area of 6415 km² and situated approximately between 10°15'–10°55'N and 38°25'–39°30'E (Figure 2). The altitude of the sub-basin ranges between 1070 and 4200 meters above sea level and characterized with agroecology types ranging from tepid to cool moist and sub-moist mid-highlands (*woinadega*), and cold to very cold moist/sub-moist and sub-alpine to alpine in parts of the highlands (*dega and wurch*); and the lowlands in the western and southern parts of the basin being hot to warm moist and dry lowlands (*kolla*). This diverse agroecology enables the sub-basin to produce different crop, fruits and vegetable types; and rearing of varied types of livestock (SWDoFED 2017). The area receives annual rainfall ranging between 800 and 1390 mm; while the annual maximum and minimum temperature range between 13–31°C and –0.5–16 °C, respectively (Aster and Seleshi 2009). The area is characterized by both wet and dry seasons; and receives its maximum rainfall from June to September (main rainy season – locally known as *kiremt*); and February to May is the small rain season, which is locally known as *belg* (Aster and Seleshi 2009; Rosell 2011). Thus, crop production follows a bimodal rainfall regime (with single maxima type) leading to two harvesting periods (Kassa and Eshetu 2014; SWDoFED 2017) but the small rainy season is erratic and highly variable and experienced frequent failure which hampers *belg* harvesting considerably (Rosell

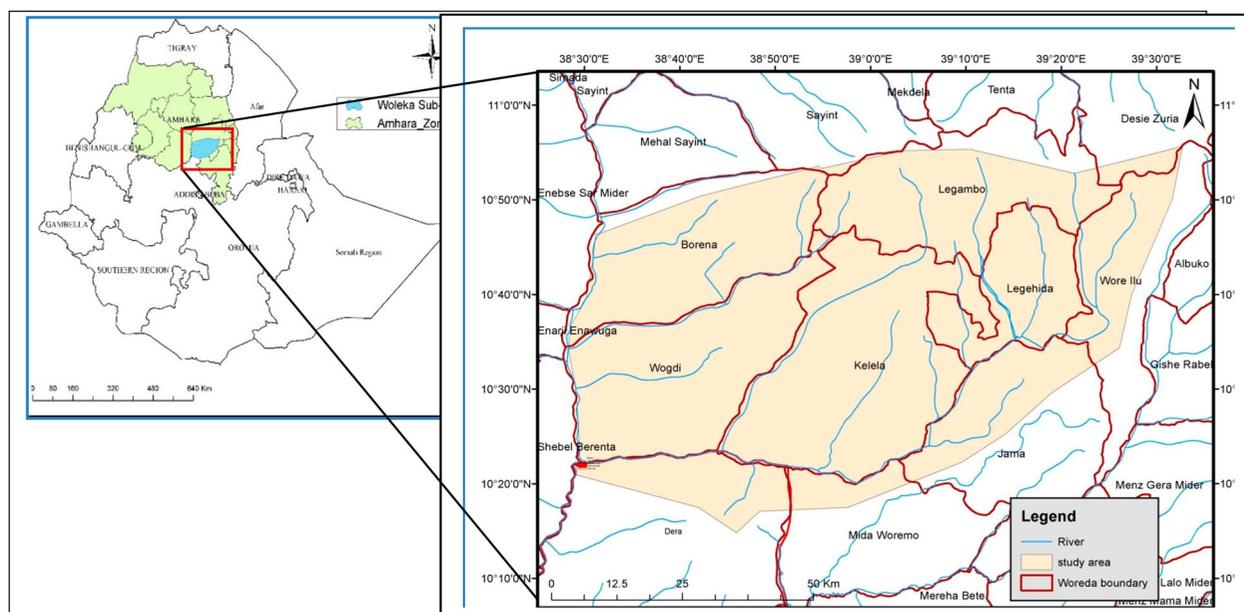


Figure 2. Relative Location of Woleka Sub-basin.

2011; Ayalew et al. 2012). Delayed onset and early cessation as well as poor *belg* performance make crop production challenging in the area. The rugged and bare mountains of the area also enhance runoff resulting into land degradation and hence low productivity. All these make the sub-basin as one of a drought-stricken and food-deficit areas of the country where food aid is a major source of livelihood for most of the population (Lakew et al. 2000; Bantider, Hurni, and Zeleke 2011; Kahsay 2013).

The study area is among highly deforested parts of the country which is attributed due to prolonged cultivation, overgrazing, expansion of settlement and improper land utilization, among others (Kassa and Eshetu 2014; Alemayehu 2017; SWDoFED 2017) and the current land cover dominated with extensive cultivation, grasslands and shrub lands. The natural vegetation of the sub-basin can be broadly classified as wood lands, dry evergreen Montane forests, riverine and sub/Afroalpine. Riverine forests and *Acacia-commiphora* narrow-leaved deciduous wood lands are found along the major river valleys while Afro and sub-afro type of natural vegetation is found in the North and Northwest part of the basin (Alemayehu 2017). Upland extension of human settlement with sedentary agriculture practice (due to the warming trend of high land areas) has resulted in the clearance of natural vegetation and exacerbates soil erosion and land degradation. As a result, the Afroalpine and sub-afroalpine vegetation have faced a remarkable shrink both in area coverage and species composition (Kassa and Eshetu 2014; Alemayehu 2017; Cafer and Rikoon 2017; SWDoFED 2017).

2.1.2. Demographic and socioeconomic situation of the sub-basin

Woleka sub-basin has a total rural population of 950,126 (50.4% male and female population accounts 49.6%) (2017 estimate); which is around 91% of the total population of the sub-basin. With an estimated area of 6415 km², the sub-basin has a rural population density of 148 per km² which makes the area as among the densely populated rural areas of the country (SWDoFED 2017). In terms of physical infrastructure, there were around 382 primary schools, 18 secondary and 7 preparatory schools in the sub-basin. Besides, the population can get health service from 45 health centers and 3 rural hospitals which are not adequate for such large population. All weather access is restricted in connecting the woreda towns with the regional capital and relatively rural kebelles in Legambo woreda are better connected with road infrastructure. Rural people in the area are still traveling a long distance to get access to the main road which would have negative implication in enhancing their adaptive capacity to climate change.

The sub-basin is among the intensively cultivated parts of the country. Rainfed crop production (wheat–barley–teff dominated) supported by livestock rearing is the main economy of smallholder farmers (SWDoFED 2014) which are both weather-sensitive sectors. Agriculture is constrained by poor soil fertility, small per capita landholding, soil erosion and erratic rainfall; as a result, most parts of the area are chronically food insecure (Bantider, Hurni, and Zeleke 2011; Rosell 2011; Kahsay 2013; Kassa and Eshetu 2014; SWDoFED 2014). It is among the drought-prone areas in ANRS and it is among the

food insecure areas of the country while Cafer and Rikoon (2017) have also labeled the area as the ‘famine belt of Ethiopia’. High population pressure and small per capita landholding lead to continuous cultivation and result in poor soil fertility. This low productivity is further aggravated because agricultural production is reliant on the unreliable rainfall (Lakew et al. 2000; Bantider, Hurni, and Zeleke 2011; Kahsay 2013; Kassa and Eshetu 2014; SWDoFED 2014). Lakew et al. (2000) and SWDoFED (2014) disclosed that greater proportions of farmers did not produce enough food and depended largely on food aid. Nonfarm livelihood activities are not well developed (Bantider, Hurni, and Zeleke 2011; Kassa and Eshetu 2014) due to limited access to infrastructure and low level of urban development, among others. As a result, rural people do not have an alternative outlet for the increasing unemployed and underemployed workforce to relieve the ongoing pressure on land (Kassa and Eshetu 2014). To overcome land demand, farmers could change marginal lands into agricultural lands which in turn lead to further degradation of natural resources and accelerates soil erosion (ANRS 2002; Cafer and Rikoon 2017).

2.2. Research design

2.2.1. Data: type, source, tools and analysis techniques

A cross-sectional survey design was adopted to examine the determinants of smallholder farmers’ participation in non-farm livelihood strategies in the context of climate change. Primary data were collected using survey questionnaire and key informant interview (KII) from December 2015 to May 2016. Data were collected from household heads and concerned government bodies at different levels using pilot tested structured survey questionnaires and checklist. Survey data collection was carried out by well-trained data enumerators while focus group discussion and KII were carried out by the first author of this paper. Mean, percentage, Chi-square tests, *t*-test and one-way analysis of variance have been used to examine association and mean differences between those engaged in non-farm activities and their counterparts

Table 1. Total population, household heads and sample size.

Woreda	Agroecology	Total population	Household heads	Sample size
Borena and	<i>Dega</i>	93,413	19,461	130
Legambo	<i>Woinadega</i>	1,03,473	21,557	144
	<i>Kolla</i>	79,042	16,467	110
	Total	2,75,928	57,485	384

Source: Respective *woreda* SWDoFED (2017).

based on different attributes. Binary logistic regression model has been applied to identify the prominent determinates of rural livelihood diversification into non-farm activities. Quantitative analysis was triangulated with qualitative data analysis. Multicollinearity problem among independent variables was checked before running the model using variance inflation factor (VIF) and contingency coefficient. Statistical Package for Social Science (SPSS ver. 21) software has been used for data analysis. The unit of analysis in identifying determinants of smallholders’ engagement in non-farm activities was done at the household level.

2.2.2. Target population and sampling technique

For cross-sectional survey design, target populations were smallholder farmers. Samples were selected using multistage stratified random sampling technique (agroecology-cropping season-kebele-households head). Legambo and Borena *woredas* were purposively selected considering their heterogeneity in agroecology (*dega*, *woinadega* and *kolla*) and type of cropping seasons¹ (*belg*² dominated and *meher* (*kiremt*)³ dominated). Kebeles from each agroecology and household heads were selected randomly from a list obtained from corresponding kebele administrations. Totally 384 household heads (130, 144 and 110 from *dega*, *woinadega* and *kolla* agroecology, respectively) were randomly and proportionately selected from the three agroecologies (see Table 1). Moreover, 10 individuals (4 from respective *woreda* agricultural offices and 6 individuals engaged in non-farm activities) were included purposively (available sampling) for KII based on their expertise in the field of study and engagement in non-farm economic activity. The sample size determination for survey study was computed based on Cochran (1977) and Kothari (2004, 180) as

$$n = \frac{Z^2 * N * p * q}{e^2 * (N - 1) + Z^2 * p * q},$$

where *n* is the desired sample size; *N* is the total target population; *Z* is the standardized normal deviation set at 1.96 to 95% confidence level; *p* is the estimated proportion of an attribute that is present in the population (0.5); *q* is the estimated proportion of an attribute that is not present in the population (1–*p*) (0.5); *e* is the degree of accuracy required normally set at 0.05 (5% of acceptable sampling error).

2.2.3. Model specification

Binary logistic regression model (based on Tabachnick and Fidell 2013) has applied to identify the major factors which determine the participation of smallholder

farmers in non-farm⁴ livelihood activities.

$$\text{Logit}(P) = \log\left(\frac{P}{1-P}\right), \quad (1)$$

$$\text{Let } P_i = \Pr\left(\frac{Y=1}{X=x_i}\right), \text{ then we can write the model as} \quad (2)$$

$$\Pr\left(y = \frac{1}{x}\right) = \frac{\exp^{x'\beta}}{1 + \exp^{x'\beta}}; \log\left(\frac{P_i}{1-P_i}\right) = \text{logit}(P_i) \\ = \beta_0 + \beta_1 x_i. \quad (3)$$

P_i is the probability of an individual being engaged in non-farm (dependent variable) and x_i 's are independent variables affecting participation in non-farm. Therefore, the parameter β_i gives the *log* odds of whose participating in non-farm livelihood (when $x_i = 1$). We can write the model in terms of odds as

$$\frac{P_i}{(1-P_i)} = \exp(\beta_0 + \beta_1 x_i). \quad (4)$$

The dependent variable is the participation of smallholder farmers in non-agricultural economic activities (dummy variable 1 = if participated in non-farm income sources; 0 = otherwise) while a number of independent explanatory variables (see Table 4) have been used.

3. Results and discussion

Among the surveyed households, only 35.7% have income from non-farm economic activities (37.5% of male headed⁵ and 24.5% female headed); the proportion of male-headed households engaged in non-farm activities seems higher than female-headed ones. Though households engaging solely in non-farm activity are very limited (4.2%) which is similar to the findings of Bantider, Hurni, and Zeleke (2011); a considerable proportion of smallholder farmers have earned a substantial proportion of their income from such activities besides agricultural activities. Although

Table 2. Percentage of households engaged in non-farm economic activities and major types.

Engagement in non-farm activities	Options	1st	2nd	Total ^a	Rank		
	Trading of any kind	59	3	121	1		
Options	<i>N</i>	<i>%</i>	Handcrafts ^b of any type	27	17	71	3
Yes	137	35.7	Selling of fuelwood	2	7	11	5
No	247	64.3	Causal daily laborer	30	14	74	2
Total	384	100.0	Selling local liquor	19	18	56	4
			Others	0	7	7	6
			Total	137	66		

Source: Own survey (2015/2016).

^aTotal is computed as (first choice*2) + (second choice*1).

^bHandcraft encompasses activities like blacksmith/carpentry/wavering/tanning/jewelry/pottery.

the picture seems better than the case disclosed by Bazezew, Bewket, and Nicolau (2013) in Lay Gaint (25%), the overall proportion is very small as compared with the available literature in Ethiopia (84% in Eastern Harerghe (Demissie and Legesse 2013), 56.5–63.3% in ANRS (Mintewab et al. 2010), 61% in East Gojjam (Yenesew, Eric, and Fekadu 2015), 52% in Kamba district of Gamo-Gofa province (Mada and Menza 2015)); and Africa (46% in Nigeria (Shehu and Abubakar 2015) and 65% in Burkina Faso (Zahonogo 2011)). Similar proportion with our result was reported by Derajew and Rao (2016) in East Gojjam (Ethiopia) and Eneyew and Bekele (2012) in Wolaita (Ethiopia) where around 34.5% and 35.9% of rural households were engaged in non-farming activities, respectively.

The summary of statistics of the variables supposed to have an impact on the decision of smallholder farmers to pursue non-farm economic activities are portrayed in Table 4. As shown in Table 4, 86% of households were headed by male, while female-headed households comprised 14%. The average age was found to be 48.93 years which indicate that the majority are in their productive age level. The family size of the study area (5.57) is statistically higher than the national rural average 5.13 ($t(383) = 6.19; p < .01$) and the regional rural average 4.63 ($t(383) = 13.13; p < .01$) (CSA 2014, 13–20). The average year of schooling was found to be 2.92 years and this implies most of the farmers did not even complete primary level. Around 48% do have access to the credit market, average distance to the nearby market was 1.92 hours, 32% have a responsibility in the community and 31% of the respondents have reported a serious shortage of land for cultivation.

As displayed in Table 2, the major non-farm activities practiced in the study area were trading (of any kind), handcrafting (of any kind), causal daily laborer and selling local liquor. Gender wise, male-headed households have been engaged in trading, handcrafting and in causal daily laboring while selling of local liquor was the major source of non-farm income for female-headed households. Regarding this issue, Chinwe (2015) had affirmed that in many countries the ability of women to work outside the home is limited. Studies in Africa revealed that local beer brewing, fish processing, pottery, retailing and vending are the most important women-dominating activities which can be undertaken in the home. Male-headed households are more likely to participate in wage employment than female-headed households. The prominent sources of capital for the entry and operation of non-farm activities are own saving, borrowing from microfinance institutions along with support from relatives and friends. Limited access to sufficient capital, poor infrastructures

and lack of technical support and training are the major constraints mentioned by farmers which hindered them not to undertake high-return non-farm activities.

Engagement in non-farm economic activities in rural areas is conditioned by different factors. Chi-square test was executed to examine the association between extent of participation of smallholder farmers in non-farm sectors with agroecology, wealth status, educational level of the head and age groups and different attributes. Statistically significant association was found based on wealth status, educational level and age level of the household head with modest to moderate effect size; while no statistically significant difference was obtained among the three agroecologies. Better-off households, households led by literate and younger heads do have better room to be engaged in non-farm economic activities. This might be due to the absence of entry barrier, the ability to seek opportunities and the better risk-taking ability of educated ones; and easy mobility of younger heads. In rural areas where formal financial institutions are not soundly functioning, obtaining monetary asset is among the contributions of non-farm activities. Overall, households engaged in any form of non-farm activities had earned considerably higher annual additional income ($m = 3793.7$; $SD = 5504.6$) which could be used as entry income for further productive sources of income, save liquating of assets for financial constraint, satisfy the money demand of the family for health/education/food and nonfood items, and enable to purchase inputs needed in the agricultural sector.

Engagement of smallholder farmers into non-farming activities in rural areas is a cumulative result of different socioeconomic and institutional factors. As showed in Table 3, independent samples *t*-test was computed to compare the mean differences between households engaged in non-farm activities and those without such activities in different attributes. The probability of participation in non-farm sources of livelihoods favors younger and educated household heads as well as those who have had a better frequency of contact with extension workers. A similar result was reported by Shehu and Abubakar (2015) where households led by educated and younger ones were more likely to diversify into non-farm economic activities. Those who have engaged in non-farm economic activities have used more amount of fertilizer, save more money in financial institutions, exposed for fewer numbers of food insecure months, cultivate more number of crops in one harvesting season and could have more livestock (TLU) than their counterparts. No statistically significant mean difference was found in terms of total family size, landholding, dependency ratio⁶ and distance to the nearest market center.

Table 3. Descriptive statistics and *t*-test result for continuous explanatory variables.

Variables	Participation in non-farm		t-Value
	Yes (Mean)	No (Mean)	
Age of the household head in years	45.42	50.87	5.45***
Maximum class level completed by the HHH	5.22	1.65	9.55***
Maximum class level completed by wife	1.76	0.54	5.43***
Maximum class level completed by husband	4.73	1.45	8.7***
Dependency ratio	1.16	1.07	1.13
Total household size	5.57	5.56	0.05
Livestock in TLU	5.02	3.3	6.7***
Total Land in hectare	0.73	0.72	0.35
Total agricultural land in ha	0.68	0.67	0.24
Total amount of fertilizer used in kg	119.71	102.33	2.7**
Average time to the nearest major input/output market	1.82	1.99	1.27
Money saved in financial institution in ETB	4326.79	966.66	4.05***
Average number of crops cultivated in one harvesting season	4.19	3.51	5.28***
Average numbers of food insecure months	1.61	2.49	4.23***
Frequency of contacts with DAs for the last one year	3.06	2.70	3.9***

Note: *, **, *** statistically significant at 0.1, 0.05 and 0.01 alpha level, respectively.

Source: Own survey (2015/2016).

Chi-square test was employed to examine whether there is an associational difference between households engaged in non-farm economic activities and those who did not have a source of income from such sectors in terms of different discrete variables. The chi-square result revealed that the likelihood of participating in non-farm activities is more for better-off families, male-headed households, households having training in small-scale business, having more frequency of contact with Development agents (DAs) and health extension service workers, having better access for financial services, having remittance, having responsibility in the community/kebele and having early warning on climate variability issues. Participation in non-farm sources of income has enabled households to use improved seeds than non-participants. One possible reason might be the possibility of having a better income to be used in purchasing improved seeds. But, no statistically significant association was found in terms of agroecology.

Logistic regression model was used to identify determinants of smaller farmers' participation in non-farm economic activities. Accordingly, 22 variables, assumed to have an association with the participation of smallholder farmers in non-farm livelihood strategies were selected and tested in the model (see Table 4). Among the variables 10 of them were found to be statistically significant at 0.05 and 0.1 alpha levels.

The model classification ascertained the goodness-of-fit of the model where 81.8% of respondents were

Table 4. Summary statistics of key variables used in estimations.

Dependent variable: Participation of smallholder farmers into non-farm livelihood strategies (1 = Yes; 0 = otherwise)						
Independent (Explanatory) variables						
Variable	Code	Mean	SD	Min	Max	Sign
Agroecology (dummy)	AGROELGY	1.95	.79	1	3	
Age of the household head in years	HHHAGE1	48.93	9.68	21	80	±
Maximum class level completed by the HHH	HHHEDUCTN	2.92	3.9	0	12	+
Wealth status of household head (Rich = 1)	WEALTH3	0.15	.356	0	1	+
Total Land in hectare	LANDHA	0.72	0.31	0	1.88	+
Livestock holding in TLU	TLU	3.91	2.53	0	14.5	+
Training on operation and management of Small scale businesses (yes = 1)	TRNING18	0.26	0.44	0	1	+
Having a family member with vocational training (yes = 1)	TRANING22	0.12	0.33	0	1	+
Frequency of contact with DAs (ordinal)	CONDA2	2.28	.73	1	3	+
Average time to the nearest major market center	DISTMRKT	1.92	1.25	.05	7	–
Average time to the nearest all-weather road	DISTROAD	1.201	1.44	0.05	8	–
Family member having health problem (yes = 1)	ILLNESS1	0.28	0.45	0	1	–
Having access to micro finance/formal bank for credit and saving (yes = 1)	MCROFN	0.48	0.5	0	1	+
Having access to remittance (yes = 1)	RMTTNC	0.28	0.45	0	1	+
Having early warning on rainfall pattern and natural hazards (yes = 1)	ERLARWR	0.52	0.5	0	1	+
Perceiving climate change can be adapted (yes = 1)	CLVARLTY	0.63	0.48	0	1	+
Radio ownership of (yes = 1)	INFORMRD	0.45	0.49	0	1	+
Total household size in number	THHStotal	5.57	1.38	1	9	±
Dependency ratio	DEPRATIO	1.102	0.82	0	5	–
Having responsibility in community (yes = 1)	HUSRESPN22	0.32	0.47	0	1	+
Shortage of agricultural land (Yes = 1)	PROBAGRLND	0.31	0.46	0	1	+
Household headship type (male = 1)	HHHEAD	0.86	.36	0	1	+

Source: Own survey (2015/2016).

correctly classified by the model. The Omnibus tests and $-2 \log$ likelihood ratio test showed that the estimated model including a constant and the set of explanatory variable fit the data better compared with the model containing the constant only. This implies a better relationship between odds ratio (or log of odds), the probability of factors influencing livelihood diversification and the explanatory variables included in the model collectively contribute significantly to the explanation of smallholder farmers influence in livelihood diversification. Although on an individual basis, some coefficients were not significant, the pseudo- R^2 value (Cox and Snell's of 0.402 and Nagelkerke of 0.553), highly significant chi-square result and the overall percentage of correct prediction suggested that the estimated model has outstanding explanatory power. Moreover, a non-significant result of the Hosmer–Lemeshow goodness-of-fit test revealed the appropriateness (well-fitting) of the model. Multicollinearity diagnosis for continuous explanatory variables was also inspected using the VIF and tolerance statistics; and the result indicated the absence of multicollinearity problem among the explanatory variables. Furthermore, the degree of association between each dummy/discrete variable was also assessed using contingency coefficient. The maximum VIF and correlation coefficient found were 1.934 and 0.34, respectively (both are below the required threshold to consider multicollinearity problem) which evidenced the appropriateness of the independent variables for running binary logistic regression. The estimated coefficients of the logit model, together with

the standard error and marginal effects are presented in Table 5. The likelihood ratio statistics as indicated by the χ^2 statistic is significant at 1%. This suggests that all the variables included in the logit model are jointly

Table 5. Binary logistic regression output.

Variables	Coefficient Coef.(SE)	Marginal effect dy/dx
AGROELGY(<i>Dega-Ref</i>)		
AGROELGY(<i>W/dega</i>)	–0.559(.403)	–0.105
AGROELGY(<i>kolla</i>)	–0.154(.647)	–0.029
CONDA2(<i>none or once-ref</i>)		
CONDA2(2–4 times)	–0.866*(.474)	–0.162
CONDA2(5 and more)	0.779*(.432)	0.155
HHHEAD (male = 0)	–1.072**(.543)	–0.239
HHHAGE1	–0.029(.021)	–0.0058
HHHEDUCTN	0.084*(.047)	0.016
THHStotal	0.105(.125)	0.020
DEPRATIO	–0.099(.217)	–0.019
WEALTH3(<i>rich = 3</i>)	1.678***(.527)	0.382
LANDHA	–1.129*(.664)	–0.221
PROBAGRLND (yes = 1)	1.139***(.369)	0.241
TLU	0.068(.091)	0.013
TRNING18(<i>yes = 1</i>)	0.179(.344)	0.036
INFORMRD (yes = 1)	0.897**(.349)	0.178
ILLNESS1 (yes = 1)	–1.062***(.421)	–0.185
DISTMRKT	0.064(.188)	0.013
MCROFN (yes = 1)	0.765***(.332)	0.150
RMTTNC (yes = 1)	0.043(.368)	0.008
HUSRESPN22 (yes = 1)	0.622*(.329)	0.128
TRNING22 (yes = 1)	0.146(.456)	0.029
CLVARLTY (yes = 1)	–0.086(.36)	–0.017
ERLARWR (yes = 1)	0.217(0.341)	0.042
DISTROAD	–0.092(0.160)	–0.018

Notes: Number of obs = 376; LR $\chi^2(21) = 191.13$; Prob > $\chi^2 = 0.0000$; pseudo- $R^2 = 0.3912$, Log likelihood = -148.7322 ; $y = \text{Pr}(\text{NONAGRADP})$ (predict) = 0.26752292; dy/dx is for discrete change of dummy variable from 0 to 1. *, ** and *** statistically significant at 10%, 5% and 1% level of significance, respectively. All results are rounded to the nearest three decimal place
Source: Own survey (2015/2016).

significant in influencing smallholder farmers' decision to partake in non-farm economic activities. Since the parameter estimates of the logit model provide only the direction of the effect of the independent variables on the response variable; estimates do not represent the actual magnitude of change or probabilities. Thus, the marginal effects from the model which measure the expected change in the probability of a particular choice being made with respect to a unit change in an independent variable have been reported.

Existing literature (see e.g. Akaakohol and Aye 2014) revealed that the probability of participating in non-farm activities in rural areas decreases with increasing the age of the household head. In our study, though the regression result was not significant, disparities were observed among three age categories. Around 53.8% of respondents between the age of 21 and 40 had a non-farm source of income while the proportion was only 33.7% and 15.6% for those between 41–60 and 61–80 years, respectively; and the Pearson chi-square association was also significant ($\chi^2 (2) = 19.6; p < .05$). This implied that the propensity of younger heads in taking part of non-farm livelihoods is more than their counterparts. During field work, we had got the opportunity to interview two young household heads (between 30 and 35 years old) trading with chicken egg. They used to buy chicken eggs from rural and remote areas and sell it at a better price for urban dwellers. According to these respondents, though the work is challenging and tiresome, they have practiced whenever the labor demand for agricultural activities is relatively less (lean period); and the profit enabled them to cover expenses needed for their family which could be otherwise covered either by selling assets or using the money borrowed from different sources. An expert from Borena *woreda* agricultural office (coordinator of rural non-farm enterprises) had confirmed similar scenario where younger and educated individuals have been engaged better than their counterparts in non-farm activities in rural areas.

Type of headship is worth mentioning as a determinate factor in the discourse of participation of families in non-farm economic activities. Evidence from several countries suggested that within the rural non-farm sector, women are significantly more likely to engage in low-productivity and low-return activities (Malek and Usami 2009). In our study, female-headed households, being other things constant, were 23.9% less likely to participate in non-farm activities and the result was statistically significant. The result coincides with Gecho et al. (2014) and Rahman and Akter (2014). This is due to better access to finance and information as well as mobility opportunity for males while women are more engaged

in household chores and do not have the necessary time left for non-farm activities. Educational level is among the preventing barrier for entry of households into non-farm activities (Fabusoro et al. 2010). As expected, it was found that education of the household head has positive and significant effect at 0.1 alpha level indicating a positive relationship with non-farm income-generating activities. This implied that household heads with a higher level of education are more likely to engage in non-farm sources of incomes in rural areas than their counterparts. The marginal effect of 0.0165 exhibited that one extra year of schooling could increase the probability of smallholder farmers' engagement in non-farm economic activities by 1.65% when other things being constant. A similar finding was reported by Akaakohol and Aye (2014), Gecho et al. (2014) and Sallawu et al. (2016). This might be due to their better ability to look existing opportunities of income-generating activities and a better possibility of taking calculated risks.

Relatively better-off households in rural areas would have a more diversified income base while poor in urban areas pursue multiple income sources (Ersado 2003). This might be due to limited entry barriers in terms of financial accessibility. The regression result in our study supported this idea where wealthy families tend to participate more in non-farm activities. Economically affluent households were 38.2% more likely to participate in such activities as compared with poor households and the result was statistically significant at 1% probability level. A similar result was reported by Mada and Menza (2015) and Yenesew, Eric, and Fekadu (2015). Our result implied the need to consider economic status of smallholder farmers in designing development intervention schemes which would provide opportunities for the poor and marginalized segments of the population. Meanwhile, it was found in that farm size had negatively and significantly influenced the probability of livelihood diversification into non-farm activities at 10% probability level. The marginal effect of -0.221 showed that a unit increment in farm size could result in decreasing the probability of smallholder farmers' engagement in non-farm economic activities by about 22.1% holding other things constant. Farmers with large farm size are less likely to diversify the livelihood strategies into non-farm income sources. That means, farmers having more land size depend on crop production (since it requires more time and labor; and enable them to produce what their family demands) than to go for non-farm in order to satisfy basic needs. Fabusoro et al. (2010) argued that whenever farming activities provide sufficient income for the household, their tendency of diversifying into non-farm livelihoods

will be diminished. On the other hand, declining land size under population pressure may encourage rural households to diversify their sources of income. The result is similar to the findings of Yenesew, Eric, and Fekadu (2015) and Sallawu et al. (2016) where negative and statistically significant association were found. Since small farmland holding does not enable the farmers to produce enough crops for satisfying their food demand and cannot get marketable surplus; this might force them to participate in non-farm economic activities so as to supplement their income from such activities. Atamanov (2011) described that insufficient land size and its poor quality as a driving force for non-farm diversification for the households with limited and poor land resources. In the study area, households with a critical shortage of agricultural land were more likely to be engaged in non-farm activities. For example, in our study around 51% of respondents who have reported a critical shortage of cultivable land had engaged in any form of non-farm livelihood strategies while the proportion who have conveyed less constraint of agricultural land but participated in non-farm activities was only 28%. The proportion difference was found statistically significant ($\chi^2(1) = 19.2; p < .05$) with moderate effect size. Being other factors constant, shortage of agricultural land had increased the probability of households to be engaged in non-farming activities by 24.1% and the result was statistically significant at 0.01alpha level of significance. This agrees with the finding of Eneyew and Bekele (2012).

Extension services are an important element of institutional support to farmers to enhance their skill and information access. Whenever sources of weather-related information systems are rear in rural areas, DAs could play a significant role in disseminating information (Selvaraju et al. 2006). Weather and climate information systems can assist farm level adaptation and possible livelihood diversification. In our study, the propensity of households to participate non-farm activities was positively influenced by their extent of contact with DAs. Keeping other covariates at their constant, households having contact with DAs five and more times a year were 15.5% more likely to participate in non-farm income-generating activities and the result was statistically significant at 10% level of significance. Similar output was disclosed by Eneyew and Bekele (2012) and Teshome and Edriss (2013). Besides frequency of contact with DAs, having training on different aspects of livelihood and climate change adaptation has been mentioned as a viable measure to reduce drought impact (Selvaraju et al. 2006). Individuals having training on management and operation of a small-scale business and climate change adaptation would more likely to

engage in non-farm income-generating activities. In our study, both having a family member with vocational training and having training on small-scale business operation and management were not found to be statistically significant in influencing participation in non-farm livelihood strategies. The result was beyond the theoretical literature and needs to reconsider the modality and effectiveness of the training provided for farmers. Though the estimate for training was not significant, a 34-year-old respondent from Legambo woreda has shared his experience on the contribution of skill training in commencing non-farm activities as

[... after completing my education from grade 10, I could not secure a pass mark to join preparatory level and were forced to turn back into farming. Soon after, I have married and become a father of two children. Things were not as such easy; the small plot of land did not enable to produce sufficient product for the family. Besides, since the area is belg growing, frequent failure of belg harvest worsen the situation. Lastly, after having a short training on woodworking, which was organized and sponsored by NOG, I have engaged in construction activities. Now, I can support and manage my families with this activities and situations currently are much better than 10 years back.

This is a good testimony on the role of skill training in the rural areas so as to partake in non-farm economic activities.

Information is very vital as far as livelihood diversification and climate change adaptation are concerned. The likelihood of participating in non-farm activities would be high for those individuals having a market and business-related information. In doing so, radio and mobile phone are dominant sources of information in most rural areas of Ethiopia. In our study, the probability of households having a radio in participating into non-farming sources of income was 17.8% higher than the other groups; and the effect was statistically significant at 95% level of significance. Yenesew, Eric, and Fekadu (2015) had also reported similar result where the likelihood of smallholder farming rural households' participation into non-farm livelihood strategies was positively and significantly affected by the extent of listening radio and watching television.

Good health in a family, particularly the health situation of bread winner, is important to the ability to pursue livelihood activities and climate change adaptation (Bowen, Cochrane, and Fankhauser 2012). Having a family member with a health problem or need support due to age and/or disability might demand the time and resource of active members of the family and hinders their involvement in activities which requires extra time and resource. As hypothesized, the likelihood of households having a family member

with a health problem to participate into non-farm sources of income was found to be low. The marginal effect result of -0.185 revealed that other factors being normal, the probability of households having a family member with health problems were found to 18.5% less likely in participating in non-farm livelihood activities. The result is in line with the finding of Beyene (2008) that reported a negative and significant effect. In addition to the health status of the head and/or family members, higher dependency ratio in the household has a negative implication on non-farm diversification. If more elderly and children are found in the family, active household members cannot leave the household for giving daily care. The income generated in farming activities is needed for the everyday life of the presumably big household and extra capital for non-farm investments is hard to obtain (Meyer, Möller, and Buchenrieder 2008). In our study, even though the β coefficient was negative (implying inverse relationship), the effect was not found to be statistically significant. The result is congruent with the findings of Khatun and Roy (2012).

Proximity to market areas is considered as an incentive for rural population to engage in non-farm economic activities. Rural non-farm livelihoods are expected to flourish in regions with well-developed infrastructures (Rahman and Akter 2014). Farmers who lived further away from the market centers are less likely to be involved in beyond agricultural activities because it is theoretically assumed that having better access to physical infrastructures like market sites and all weather roads can increase the efficiency of both marketing and tends to raise the profitability of non-farm activities. We found no statistically significant association between distance to the nearest market and participation of smallholder farmers in non-farm economic activities. Though the regression result revealed non-significant effect, households engaged in any form of non-farm took relatively less time (1.82 hours), on average, as compared with those who did not have income from non-farm sources (1.99 hours).

One major impeding factor for smallholder farmers not to participate in non-farm economic sectors is a financial constraint (Smith et al. 2001). Having access to microfinance has a positive and statistically significant contribution for farmers to participate in non-farm sectors of the economy. The marginal effect of 0.15 evidenced that having credit access has increased the probability of participating in non-farm activities by 15% at 0.05 alpha level when other factors are taken as constant. Around 52.7% of respondents who have got financial access from microfinance institutions were engaged in non-farm income sources which imply the contribution of access to financial institutions for livelihood

diversification. A similar study by Sallawu et al. (2016) had found that accessibility of credit institution and availability of adequate loan were important factors for the participation of household in non-farm activities. Eneyew and Bekele (2012) had reported the negative and significant impact of credit access to livelihood diversification in non-farm sectors. The probable reason mentioned was the likelihood of farmers having credit access in using the money to purchase agricultural inputs which in turn will enhance productivity. Besides microfinance, having remittance is another source of finance which could probably solve entry problem to engage in non-farm economic activities. Contrary to our expectation, though the coefficient is positive, having source of money from remittance inflows did not have a significant association with the participation of rural households in non-farm economic activities. This might be due to the fact that money received from remittance is not being utilized for productive investment rather for consumption purpose. Negative and significant association between access to remittance and probability of households to engage in non-farm activities was disclosed by Malek and Usami (2009).

Case study: 'Small is Large'

The owner of a small shop in a rural village has shared his experience on the contribution of a small loan to commence his own business in the following way.

'...I have dropped my education from grade 8 and forced to help my elder parents. After the death of my father, I have got married and decided to start trading. But getting seed money was a critical challenge. Later on, we have organized (with friends) and got money from microfinance institution through group collateral. Immediately, I have opened a small shop which is managed by my wife and me. Fortunately, we are lucky enough and able to pay back all my debts shortly. Generally, microfinance has changed our life considerably particularly when it is compared with the situation of farming alone. Now, I can run the business using my own capital and started to build our own house in the nearby town. I have planned to shift to the nearby town for better market. Small loan received from microfinance institution has changed my life ... small is not small, rather small is large'. This testimony could prove the contribution of microfinance in rural areas for livelihood diversification where entry capital is the major constraint.

Social capital has a significant implication in livelihood diversification discourse. Scholars argue that having a responsibility to the community and/or kebele administration would have a positive contribution which encourages households to partake in non-farm economic activities (Davis 2003). The probable reason is that individuals' participation in local leadership can help to have more access to information, share more experience with others in a social environment, creating a more social network with outside societies, get more access to formal as well as informal credits. With regard to credit access, local leaders are more trusted and accepted by formal and informal financial institutions (Gecho et al. 2014). As expected, a positive and

statistically significant association between extent of participation of household heads in different community leadership activities and having a non-farm source of income was found at 0.05 alpha level. The result indicated that other factor kept constant, the marginal effect (0.128) of the model result exhibited that the probability of participating in non-farming economic activities increases by 12.8% as a household head has a leadership role in the community (like a religious leader, *kebelle* administrator, *Idir* leaders, school-parent association). A similar finding was found by Khatun and Roy (2012) and Gecho et al. (2014).

In this analysis, agroecology, total livestock size in TLU, age of the household head, having training on operation and management of small-scale business, having a family member with vocational training, distance to nearest all-weather road, perceiving that climate change can be adapted, dependency ratio, having early warning access, total family size, remittance, per capita landholding and distance to the nearest market were not found to be factors affecting participation of farmers into non-farm economic strategies significantly.

4. Conclusion and policy implications

Mixed farming which encompasses crop production and animal husbandry is the major source of livelihood in the study area. Agricultural practice is predominantly rainfed; this makes the livelihood of smallholder farmers at mercy of nature. Though their contribution is less, non-farm activities are supplementary sources of livelihood for a greater proportion of households. Although having source of income from non-agricultural economic activities has been integrated with agricultural activities, the contribution of such economic activities to the overall income of households is very limited. The prominent non-farm economic activities practiced in the study area are petty trading, casual daily laborer, handcrafting of different forms and selling local liquor which demands less skill and entry capital. Binary logistic regression model result revealed that, better-off households, households led by literate and younger heads and having access to microfinance, having frequent contact with DAs, and having responsibilities do have better room to be engaged in non-farm economic activities. Having income sources from non-farm activities makes a difference in overall income of smallholder farmers in the study area. Generally, non-farm livelihood diversification in the study favored the better-off groups and special support has to be given for the marginalized sections of the population.

In countries where economic activity is highly sensitive to climate variability and change, relying on

agriculture-based livelihood activities alone could increase the likelihood of vulnerability of smallholder farmers to climate change-induced impacts. Expansion of rural non-farm economies which requires low entry capital and suitable for home-based activity would be viable adaptation option to climate change-induced shocks. As non-farm activities would help farm households to employ their labor hour efficiently and contribute in absorbing rural surplus labor, enable to increase agricultural productivity, and since they enable rural household not to liquidate their assets due to credit constraints; non-farm livelihood diversification strategies need to be incorporated in the rural development policies and technical as well as financial supports have to be given to the farming households. Since land per capita is very small (0.14 ha) ($t(383) = 15.44; p < .01$), as compared with minimum expected size of 0.2 ha per capita (ANRS 2006); and since the area is among the highly vulnerable areas of the country to adverse impacts of climate change (Bantider, Hurni, and Zeleke (2011)), relying on agriculture alone makes the effort of achieving food security and improving the welfare of smallholder subsistence farmers. Thus, creating a conducive environment for the development of non-farm sources of income apart from farming will play a crucial contribution to minimize risks and to improve the welfare of subsistence farmers. To that end, rural-based institutions like producers' cooperatives, farmer training centers and agricultural extension programs should integrate non-farm diversification as part of their program. Moreover, targeted interventions and all rounded supports are needed to enable poor and female-headed households to participate in non-farm economic activities. Policy makers and other government stockholders should have to focus in strengthening the role of DAs, providing microfinance (which is among the entry barriers) to the marginalized portion of the society, entrepreneurial training and skill development through adult literacy programs and formal education, infrastructure development would probably enhance the participation of smallholder farmers in non-farm activities. Though the Ethiopian government has considered as an alternative livelihood strategy in rural areas only in the recent times, still the attention given for this sector both in Agriculture Development-Led Industrialization and Growth and Transformation Plan; and its contribution is very low. We recommend that, special package program has to be designed so as to promote non-farm economic activities in the rural areas besides farming and should be incorporated among the major rural extension programs. Besides, NGOs working in the rural areas should also support the development of non-farm livelihood strategies as well.

4.1. Limitation

Data for this research were collected at snapshot and do not consider the dynamic nature of rural livelihoods through time (which can be better addressed through longitudinal studies). Furthermore, a unit of analysis was at household level and no attempt was done in differentiating which family member(s) is/are being involved in non-farm activities. Shocks and risks, which are expected to be among the push factors, are not considered as a driving force for non-farm activities. Meanwhile, it only tried to address the determinants of participation and the role of non-farm economic activities in improving the welfare of smallholder farmers was not studied in-depth. Further research should be carried out by taking these limitations into account and investigating the actual contribution of non-farm activities in improving the well-being of smallholder farmers in such drought-prone areas.

Disclosure statement

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Notes

1. Cropping season refers to the major source of rainfall for crop production. It has been included because agroecology alone does not capture the issue of heterogeneity in farming society.
2. *Belg* (short rain season) which extends from (February–May).
3. *Meher* or *Kiremt* (long rain season) which extends from June–September (NMA, 2007, 19).
4. Non-farm or non-agricultural activities comprise those sources of livelihood for smallholder farmers rather than crop production and animal husbandry; and include income sources from mining, manufacturing, utilities, construction, commerce, transport, financial and personal services (e.g. petty trading, wage laborer, hand-crafting of any type and the like) (Haggblade, Hazel, and Reardon 2007).
5. No differentiation was done whether the non/off farm activity is owned either by the husband, wife or any member of the family.
6. Dependency ratio is the number of household members aged below 15 as well as above 64 divided by the number of household members aged between 15 and 64.

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