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Determinants of livelihood diversification strategies in Eastern Tigray Region of Ethiopia

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Abstract

Background: In Ethiopia, farm households engage and pursue diverse off-farm and non-farm livelihood activities to cope with diverse challenges such as drought. Due to the unstable and meagre agricultural context of the study area, farm income alone could not feed the ever increasing population. Without adopting context based livelihood diversification strategies; the challenge it presents could neither meet nor attain household food security and improve livelihood security. The objective of the study was to analyse the determinants of livelihood diversification strategies among rural households in Eastern Tigray Region of Ethiopia.

Methods: Multistage sampling technique was used in selecting the study sites and 485 sample respondents. Data were triangulated with information collected using focus group discussion and key informants interview to draw qualitative conclusion.

Results: Majority (83.1%) of the farmers were able to diversify their livelihoods into either off-farm or non-farm or combined income activities, whereas the remaining 16.91% of the households were unable to diversify; often lacking the means to engage in any form of income-generating activity apart from agricultural activities. Results of the multinomial logistic regression model revealed that households choice and adoption of livelihood diversification strategies were positively affected by households level of education, access to credit, income, membership to cooperatives, land size, and farm input use, whereas age, dependency ratio, family size, access to extension services, distance to market, livestock ownership and agro-ecology negatively affected.

Conclusions: Diversification into non-farm activities plays a significant role in the context of inadequate and rain-fed-dependent agricultural income households. Households who diversified their livelihood activities are the ones who able to build better asset and less vulnerable than the undiversified ones. Smallholder farmers' food security and livelihood improvement can only be realized if the government give due attention and put the right policy measures in place that support non-farm livelihood diversification as part of national job creation for saving life of many people and better livelihood.

Keywords: Determinants, Livelihood diversification, On-farm, Off-farm, Non-farm, Income, Ethiopia

Background

Livelihood diversification is a process by which rural households construct a diverse portfolio of activities and social support capabilities in their struggle for survival and improvement in their standards of living [1] and the means of gaining a living [2]. It can be defined as the maintenance and continuous alteration of highly

varied range of activities and occupations to minimize household income variability, reduce the adverse impacts of seasonality, and provide employment or additional income [1, 3, 4]. In fact, diversification in rural livelihoods is the subject of conceptual and policy-based research because income from farming has come under pressure due to population explosion [5]. Agriculture in the study area is at subsistence stage, complex, diverse and risk prone. It is also characterized by severe drought, rainfall dependence, poor soil fertility, high population growth and small farm land that push the rural households to

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diversify their livelihood strategy into non-farm income activities. The context of various risks implies that farm households livelihood diversification is primarily a risk management strategy; both risk adaptation in anticipation of shocks and coping after actual shocks. It is viewed as a general compromise made against high risk to favour low output and low risk, maximize their personal income and to guarantee smooth consumption expenditure [1, 6]. Farm households engage and pursue diverse non-farm livelihood activities to cope with diverse challenges and risks such as drought [4, 6, 7]. Non-farm activities have the potential to help households reduce poverty by offering them with a form of insurance against the threats of farming and minimizing reliance on natural resources. Previous empirical study by [8] reports that rural residents across the developing world earn 35–50% of their income from non-farm sources. In Ethiopia, empirical studies found that non-farm income accounts for as much as 40–45% of the average households income [9, 10]. In this regard, it is obvious that the contribution of non-farm income is immense but varies from place to place and people to people due to different contextual factors.

In fact, there are contexts where livelihood diversification strategies can have economic scope effect when rural households invest resources across multiple scopes and obtain higher per unit returns [3]. Farmers also need to diversify due to their inability to specialize and to get sufficient income, and also the need to make self-insurance against drought. Especially, the better of rural households that do not only diversify for survival but also for enhancing better financial returns and then accumulation of wealth for a better life. In addition to this, empirical studies consistently show that diversification to non-farm livelihood strategies enables farm households to have better incomes, enhance food security, and increase agricultural production by smoothing capital constraints and help coping with environmental stresses [3, 4, 11, 12]. Farm households that engage in highly productive non-farm activities typically enjoy upward mobility in earning [3, 13]. The distribution of income and wealth status play crucial role in households' choice over which type of livelihood diversification strategy to select and apply. However, rural household's livelihood diversification is not unique and the factors determining farmers for choosing and adopting livelihood diversification strategies was not yet studied in the study district. Therefore, the objectives of this study were to: (1) identify choices of household livelihood diversification options and (2) analyse the determinants of livelihood diversification strategies among rural households.

Research methods

The study sites

The study was conducted during the year 2016/17 in Saesietsaeda Emba district, Eastern Zone of Tigray, Ethiopia which is found at about 883 km north of Addis Ababa. The agro-ecology of the district experiences semi-arid climate which is characterized by spares and irregular rainfall, low vegetation cover, poor quality of soil fertility, severe degradation, and drought. The study district receives an average annual rainfall ranging from 350 to 500 mm and temperature ranging from 13 to 20 °C. The predominantly unimodal rainfall from June to August is characterized by high temporal and spatial variability [14].

Types and methods of data collection

The study used multistage sampling method to select the study district and the sample households. First, the study district was selected purposively out of the seven districts in Eastern zone of Tigray because of its drought proneness, high population pressure, land degradation, scarcity of high cultivable land, existence of high out-migration and prevalence of food insecurity [15]. Second, stratified sampling technique was used to select five rural Kebele¹ administrations (KAs) out of the 25 rural KAs. The selected Kebeles are Raele, Hawile, May-megelta, Sendeda and Sewne. Finally, 485 sample households were selected using proportional sampling followed by systematic random sampling technique from the study Kebeles. Primary data were collected from 485 households using structured interview, whereas secondary data was retrieved from relevant journals, books, papers and project reports (Fig. 1).

Method of data analysis

Data were analysed using one-way ANOVA such as mean, standard deviation, maximum, minimum, percentage, frequency, and Chi-square test. Multinomial logistic (MNL) regression analysis was estimated to analyse the determinants of livelihood diversification strategies among rural households analyse determinant factors for households to choose and adopt livelihood diversification strategies where the dependent variable has multiple outcomes [$j=1, \dots, 4$, where a household choice is relying on $j(1)=$ on-farm alone; $j(2)=$ on-farm + off-farm; $j(3)=$ on-farm + non-farm; $j(4)=$ on-farm + off-farm + non-farm income-generating activities]. The estimation of the MNL model was made by normalizing on-farm alone livelihood strategy

¹ Kebele is the lowest administrative unit in Ethiopia as peasant association in other countries.

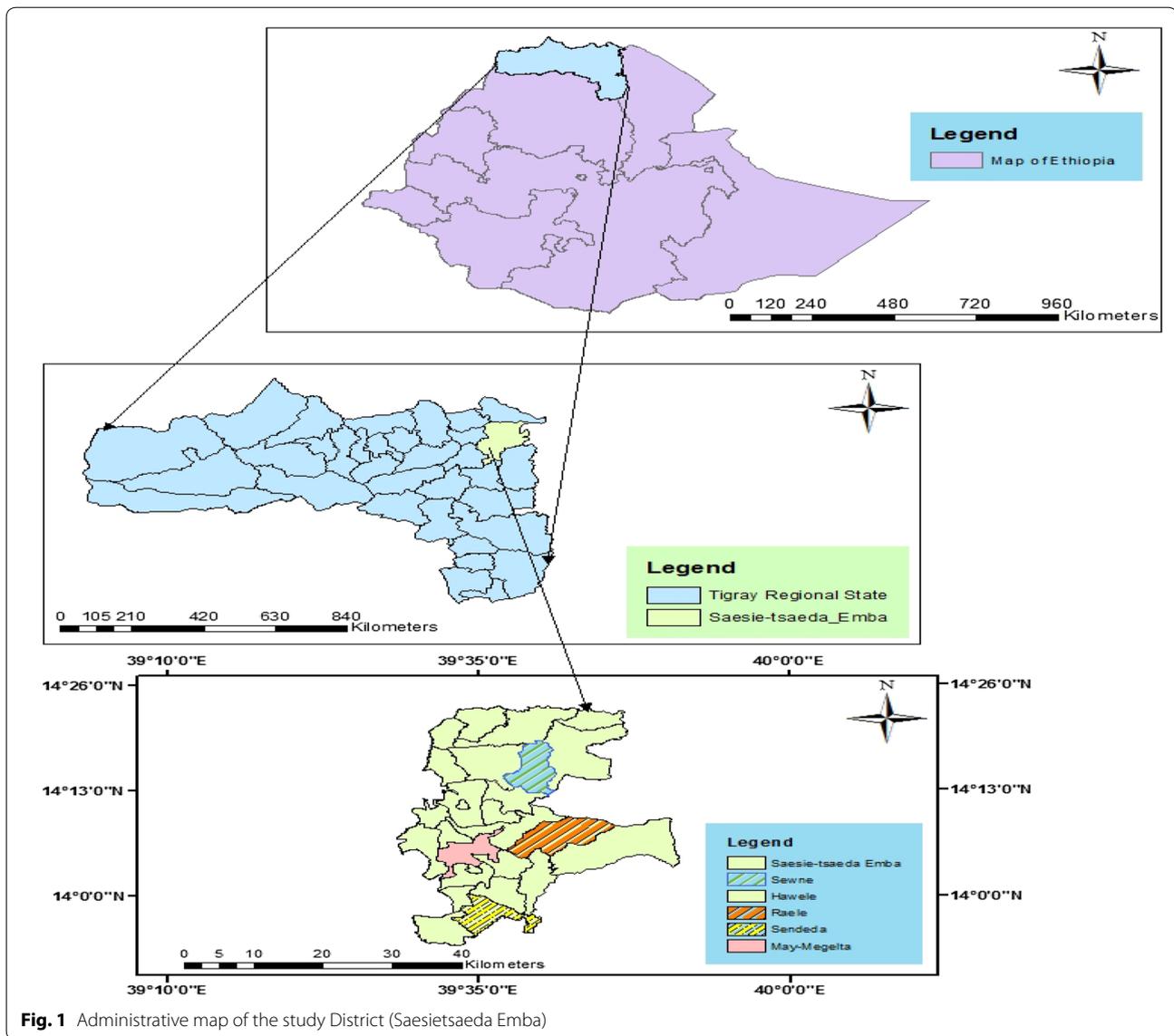


Fig. 1 Administrative map of the study District (Saesietsaada Emba)

as reference category for analysis. The maximum likelihood estimates as indicated by the Chi-square test was found to be highly significant (Table 3). Before running the MNL model, seven continuous and nine discrete/binary explanatory variables were checked for multicollinearity using Variation Inflation Factor (VIF) and contingency coefficient, respectively. The VIF for all the continuous variables were less than 10 and greater than one. Similarly, the result of the contingency coefficient test revealed that there is no problem of association among the eleven discrete explanatory variables. This indicates no serious problem of multicollinearity. Therefore, all the hypothesized explanatory variables (Table 1) which were expected to affect the choice and adoption of household livelihood diversification

strategies were included in the MNL analysis using SPSS version 20, and only the statistically significant variables are discussed (Table 3).

Results and discussion

Household livelihood diversification strategies

Results (Table 2) depicted that majority (83.1%) of the farmers were able to diversify their livelihoods into either of the three livelihood diversification strategies or combined income activities, whereas the remaining 16.9% of the sample households were unable to diversify their livelihoods, often lacking the means to engage in any form of income-generating activity aside agriculture. They are totally dependent on crop and livestock husbandry. On the other hand, 11.5, 59.8 and

Table 1 Description of variables used in the model

Choices (j)		Livelihood diversification strategies
j = 1, ON		On-farm alone
j = 2, ON + OFF		On-farm + off-farm
j = 3, ON + NF		On-farm + non-farm
j = 4, ON + OFF + NF		On-farm + off-farm + non-farm
Variables	Description and unit of measurement	Expected sign
SEX	Binary, 1 if the head is male and 0 if female	+/-
AGE	Continuous, age of household head in years	+
EDUCATION	Categorical, education level of household head in years	+
FAMILYSIZE	Continuous, family size of the household in adult equivalent	+
INCOME	Continuous, annual income of the household head in ETB	+
DEPENDANT	Continuous, family members < 15 > 64 old age in adult equivalent	-
LANDSIZE	Continuous, land size holding of the household in hectare	+
IRRIGATION	Binary, 1 if head has access to irrigation and 0 otherwise	+
INPUTUSE	Binary, 1 if head has access to agricultural inputs and 0 otherwise	+
EXTENSION	Binary, 1 if head has access to extension services and 0 otherwise	+
COOPRMEM	Binary, 1 if head has access to formal cooperatives and 0 otherwise	+
REMITANCE	Binary, 1 if head has access to economic support and 0 otherwise	+
CREDIT	Binary, 1 head has access to credit and 0 otherwise	+
DISTANCE	Continuous, distance to market in km	-
LIVESTK	Continuous, total livestock ownership in tropical Livestock unit (TLU)	+
WEALTH	Categorical, 1 if better off, 2 if less poor and 3 if poor	+

Table 2 Choice of livelihood diversification strategies adopted by the sample households

Choice of livelihood diversification strategies	Frequency	Per cent	Cumulative %
On-farm only	82	16.9	16.9
On-farm + off-farm	56	11.5	28.5
On-farm + non-farm	290	59.8	88.2
On-farm + off-farm + non-farm	57	11.8	100.0
Total	485	100.0	

11.8% of the sample households were able to diversify into on-farm + off-farm, on-farm + non-farm, and on-farm + off-farm + non-farm income-generating livelihood strategies, respectively (Table 2).

The already declining size of farm land coupled with the high population growth could have a potentially negative impact on rural welfare and food security in Sub-Saharan Africa (SSA) [4, 8, 16]. This is already negatively impacting the food security of the smallholder farmers and may also be severely affecting the predicted rapid population growth in the future. Secondly, Agricultural production and productivity is being challenged by the continuing drought occurrence coupled with limited farm land, poor

usage of improved agricultural inputs and high population growth. As a result of this and other factors, the agricultural sector could not absorb the rural productive labour force. In converse, it aggravates the already unstable livelihood situation of the farmers.

Determinants of smallholder farmer’s livelihood diversification strategies

Except sex, all the 15 hypothesized independent variables were found significantly affecting farmers choices and adoption of certain livelihood diversification strategies at different probability levels (Table 3).

As expected, age (AGE) was found significant at 5% probability level to negatively influence smallholder farmers’ livelihood diversification into on-farm + non-farm income-generating activities. Interpretation of the odds-ratio implies that if other factors are held constant, the odds-ratio in favour of the probability of the household to choose on-farm + non-farm income-generating livelihood strategies of the household decreases by a factor of 5.750 as the age of the household increases by 1 year. The probable reason is that young households are relatively better educated, have better access to technologies, and look alternative livelihood opportunities. Education level of the household head (EDUCATION) was found to be one of the most important determinants of

Table 3 Result of multinomial logistic regression model

Independent variables	On-farm + off-farm			On-farm + non-farm			On-farm + off-farm + non-farm		
	Coefficient	SE	OR	Coefficient	SE	OR	Coefficient	SE	OR
	Intercept	5.601*	3.139	3.185	6.440*	2.513	6.568	5.327*	3.112
SEX	.433	.545	.631	.085	.441	.037	.919	.571	2.593
AGE	-.009	.018	.242	-.034**	.014	5.750	-.002	.020	.014
EDUCATION	.735*	.391	3.536	.463***	.300	2.373	.233***	.392	.354
FAMILYSIZE	-.203*	.115	3.108	-.042**	.082	.266	.050	.117	.179
INCOME	.000***	.000	23.915	.000***	.000	24.367	.000***	.000	23.269
DEPENDANT	-.332**	.162	4.185	-.078	.124	.399	-.011	.170	.004
LANDSIZE	-.362	.298	1.471	.556***	.209	7.056	.044	.279	.025
IRRIGATION	-.980*	.568	2.980	.444	.488	.825	.466	.616	.571
INPUTUSE	1.077	.838	1.653	1.347*	.730	3.406	.893	.952	.879
EXTENSION	-.550***	.161	11.660	-.187	.131	2.044	-.399**	.174	5.263
COOPMEM	.364	.440	.685	.903***	.330	7.506	1.099**	.453	5.898
REMITANCE	.230	.592	.152	.900**	.428	4.431	-1.902	.510	13.929
CREDIT	-.396	.514	.593	.581	.417	1.946	1.222***	.520	5.519
DISTANCE	-.094*	.054	3.042	-.050	.037	1.805	-.009**	.041	.046
LIVESTK	-.055**	.026	4.371	.014	.019	.531	-.053*	.028	3.564
WEALTH	.237	.275	.738	.181	.217	.696	.738***	.287	6.595

The reference category is: on-farm alone

Maximum likelihood estimates

Dependent variable	Livelihood diversification strategies
Number of observation	485
- 2 Log likelihood model fitting	Intercept only: 1075.644, Final: 798.242
Chi-square test	277.403
Degrees of freedom	54
Significance	0.000

***, **, * Significant at less than 1, 5, and 10% probability level, respectively

livelihood diversification as prior expectation. Education level has a positive and significant ($p < 0.1$, $p < 0.01$, and $p < .01$) relationship with households livelihood diversification into on-farm + off-farm, on-farm + non-farm and combination of on-farm + off-farm + non-farm livelihood diversification strategies, respectively. The result of the odds-ratio depicts that, keeping other factors constant, the odds-ratio in favour of the likelihood of the households to choose on-farm + off-farm, on-farm + non-farm and combination of on-farm + off-farm + non-farm livelihood diversification strategies will increase by a factor of 3.536, 2.373 and .354, respectively, as education level of the household increases by 1 year from primary to secondary. The highly educated persons diversify their livelihood options via opting for salaried jobs, self-employment, trading, etc., whereas the illiterate and poorly educated households are forced to engage themselves in low-priced labour, wage earnings and have even less chance to work in non-farm activities compared

to the educated once. Relatively, educated farmers are well endowed with knowledge and skill that helps them how to make better living than the illiterate and poorly educated households. The result of this finding is in line with the findings obtained by [17].

Productive family size adds significantly to the share of total income received from farming by participating in different non-farm income diversification strategies. However, contrary to prior expectation, household size (FAMILYSIZE) negatively and significantly ($p < 0.1$ and $p < 0.01$) influenced the participation of households in on-farm + off-farm and on-farm + non-farm income diversified livelihood strategies. Interpretation of the odds-ratio depicted that, if other factors held constant, the odds-ratio in favour of the probability of the households to diversify into on-farm + off-farm and on-farm + non-farm income diversified livelihood strategies decreases by a factor of 3.108 and .042, respectively, as the family size of the household increases by one. The underlined

point here is that large household size does not mean all the household members are productive labour force. This is due to the fact that some of the household members are physically disabled and mentally disordered due to the past war between the current government of Ethiopia and the military regime of Derg; and also due to the Ethio-Eritrean war from 1998 to 2002 and other diseases in the study area. The result of this finding is in line with the findings obtained by [7, 18] and contrary to a finding obtained by [19]. In line with this, the coefficient of dependency households (DEPENDANT) was found to have negative relationship with on-farm + off-farm choices of household livelihood diversification strategies and statistically significant at 5% probability level. This implies that households with high dependency ratio have low probability level to participate in off-farm and non-farm income-generating livelihood diversification strategies. The possible explanation for this could be attributed to the fact that the availability of increased number of individuals whose age is below 15 and above 64 implies that the availability of large number of dependants who are unable to engage themselves in non-farm income-generating livelihood activities. The result of this study is consistent with the finding obtained by [20].

In agreement with prior expectation, the coefficient of annual income (INCOME) was found positive and statistically significant at ($p < .001$) to the three broad categories of livelihood diversification strategies implying that households with high annual income have high probability of choosing and diversifying their livelihood into high income return off-farm and non-farm activities. If other factors remain constant, the odds-ratio in favour of the smallholder farmers to choose on-farm + off-farm, on-farm + non-farm and combination of on-farm + off-farm + non-farm income activities increases by a factor of 23.915, 24.367 and 23.269, respectively, as income of the household increases by one ETB. The result of this study is consistent with the findings of [3, 21, 22]. Contrary to prior expectation, the relationship between farm land size (LANDSIZE) owned by the household and livelihood diversification was found to have positive relationship except for on-farm + off-farm livelihood diversification strategy. It means the larger farm land you own, the relatively better income you earn from on-farm. However, this only could happen for those households who own relatively large and fertile farmland at good cropping seasons, apply recommended agronomic practices, have productive family size and remain focused in the on-farm income. Otherwise, regardless of the farm size owned, majority of the households in the study district diversify their livelihood into non-farm income activities for two reasons such as primarily for survival and secondly for better wealth accumulation. In fact, on-farm income in

the study district cannot feed the whole family and guarantee farmers from diversifying their income activities. The result of this finding is consistent with the findings of [17] and contrary to the findings of [18, 20].

As expected, access to irrigation (IRRIGATION) has found positively and significantly affected households' livelihood diversification strategy into on-farm + off-farm at 1% level of significance. Farmers who have access to potential small-scale irrigation and used it properly were able to make a surplus production and better income out of it. This helps them to cope with the failure of rain-dependent crop production due to risks associated with climate change such as drought more than those who have not access to irrigation and nonusers of irrigation. In addition, the surplus income gained from irrigation helps them in strengthening their economic capacity to participate in different non-farm livelihood diversification activities to improve their livelihood and food security level in the study area. Similarly, the estimated coefficient for input use (INPUTUSE) has found positively and statistically affected households' participation in on-farm + non-farm livelihood diversification strategy at 10% level of significance. Access to agricultural inputs and its recommended application practices are an indispensable part of improving agricultural production and productivity. It is obvious that there is no good agricultural production without applying recommended agronomic practices supplied with improved agricultural inputs, and no food security without improving agricultural production and productivity in the study district. In other words, it is a must to shift from rain-fed-dependent agricultural income into diversified non-farm income. The result of this study is in line with the findings by [23].

Against to prior expectation, livestock holding (LIVESTK) in tropical livestock unit (TLU) has negatively and statistically affected households' participation in on-farm + off-farm livelihood diversification strategy at 5% level of significance. Similarly, livestock holding has negatively and statistically affected household's participation in on-farm + off-farm + non-farm livelihood diversification strategy at 10% level of significance. The odds-ratio revealed that, if other factors remain constant, the likelihood of rural households to choose on-farm + non-farm and combination of on-farm + off-farm + non-farm livelihood diversification strategies decreases by a factor of 4.371 and 3.564, respectively as the livestock holding increases by one TLU. This means rural households who own more TLU have more probability to remain without diversifying their livelihood options into on-farm + off-farm and/or combination of the three (on-farm + off-farm + non-farm) livelihood strategies but able to diversify into on-farm + non-farm income activities. The possible reason for this is that households who own more

TLU could earn much money by selling their livestock and able to strengthen their financial capacity which is very essential for entry to non-farm income-generating activities. This result is in line with the findings of [19, 24, 25].

Access to extension services plays a central role in improving and attaining the goal of agricultural and rural development goals. As expected, the results of the estimated coefficient showed a negative and statistically significant relationship ($p < 0.01$ and $p < 0.05$) between frequencies of extension contact (EXTENSION) and farmers livelihood diversification into on-farm + non-farm and on-farm + off-farm + non-farm activities, respectively. Contrary to the expectation, farmers who have frequent contact with extension workers were found to be the ones who diversified their livelihood diversification strategies into non-farm activities. The possible explanation for this could be that extension workers are not only providing agricultural extension services to farmers but also entrepreneurial skills, the entry point for participating in non-farm income business activities. The result of this study is consistent with the findings of [26]. As projected, the sign of the estimated coefficients was found to have positive relationship between membership to cooperatives (COOPMEM and on-farm + non-farm and combination of on-farm + off-farm + non-farm livelihood strategies and statistically significant at $p < 0.01$ and at $p < 0.05$ probability level, respectively. If other factors remain constant, the odds-ratio in favour of the smallholder farmers to choose on-farm + non-farm or combination of the three (on-farm + off-farm + non-farm) livelihood diversification strategies increases by a factor of 7.506 and 5.898, respectively, as membership to cooperatives increases by one. Households who are members of formal cooperatives gain benefits like sharing income and labour, access to credit, reduced individual transaction cost, updated market information on farm produce such as on inputs and farm equipments. The result is in agreement with previous findings obtained by [20].

The result of the MNL regression model revealed that remittance income (REMITANCE) was found to have positively and statistically affected household's participation in on-farm + non-farm livelihood diversification strategy at 5% level of significance. If other factors are held constant, the odds-ratio in favour of the smallholder farmers to choose on-farm + non-farm livelihood diversification strategies increases by a factor of 4.431 as remittance income increases by one ETB. Hence, increasing rural households remittance income plays a vital role for enhancing and smoothing household consumption problem, strengthen social network/social capital, increase saving and investment, help households gain access to

diversified opportunities like trading, and then able to improve their livelihood. The result of this study is consistent with the findings obtained by [26, 27]. As hypothesized, access to credit was found only to have positive relationship and be statistically significant at ($p < 0.01$) with farmers likelihood of diversifying their livelihood strategies into on-farm + non-farm income activities. Keeping other factors constant, the odds-ratio in favour of the smallholder farmers to choose combination of the three (on-farm + off-farm + non-farm) livelihood diversification strategies increases by a factor of 5.519 as access to credit increases by one. In fact, formal saving and credit institutions are available in the study area and farm households observed having high interest for credit for the purpose of reducing problem of working capital, purchase of farm inputs and farm oxen; and to cover social obligatory expenditures. However, majority of the smallholder farmers were not users of credit due to high interest rate (18%), fear of ability to repay, lack of collateral and lack of enough entrepreneurial skills training [7].

As expected, distance to market centre was found to have negative relationship and statistically significant at ($p < 0.10$ and $p < 0.05$) probability levels with household's likelihood of livelihood diversification into on-farm + off-farm and on-farm + off-farm + non-farm income-generating activities, respectively. Interpretation of the odds-ratio for the distance from nearest market centre indicated that keeping other factors constant, the odds-ratio in favour of the smallholder farmers to choose on-farm + off-farm and/or combination of the three (on-farm + off-farm + non-farm) livelihood diversification strategies decreases by factor of 3.042 and .046 as the distance from the household's home to market centre increases by one km. It is clear that the more households are distant from market centre, the more disadvantaged from diversifying their livelihood income into non-farm options. As expected, wealth (WEALTH) has positively and statistically affected households' likelihood into on-farm + off-farm + non-farm livelihood diversification strategies at 10% level of significance. Keeping other factors constant, the odds-ratio in favour of the probability of the households to choose on-farm + off-farm + non-farm livelihood diversification strategies increase by a factor of .738 as wealth status of the household increases by one unit. It is true that individuals with a high initial livelihood asset have greater freedom of choosing high return non-farm activities and benefit most. The result of this study is consistent with the findings of [4, 7, 13, 19, 27, 28].

Conclusions and recommendations

The study concludes that smallholder farmers at Saesit-etsaeda Emba district of Eastern Tigray Ethiopia use diverse livelihood strategies to achieve their prioritized livelihood objectives. The primary objective of the poor households was for survival, whereas the primary objective of the better-off households was for wealth accumulation and better living. Majority of the households in the study area have unevenly diversified sources of income. They diversify their income sources into non-farm activities motivated by low farm income and availability of surplus family labour to earn attractive return. In fact, households who diversify their livelihood activities are less vulnerable than the undiversified farm households. Majority (83.1%) of the sample households were able to diversify into on-farm + off-farm or on-farm + non-farm or combination of on-farm + off-farm + non-farm livelihood strategies, whereas 16.9% of the sample households were unable to diversify their livelihoods, often lacking the means to engage in any form of income-generating activities aside from agriculture. It is noteworthy that despite the less attention given by the government, non-farm activities play significant role in the context of inadequate and rain-fed-dependent subsistence agricultural income areas.

Furthermore, results of the multinomial logistic regression model attested that households' choice and adoption of livelihood diversification strategies were positively determined by the households' level of education, access to credit, income, membership of cooperatives, remittance income, farmland, access to irrigation and access to credit, whereas age, dependency ratio, family size, access to extension services, distance to market, livestock ownership and agro-ecology were found to have negative relationship and significantly affecting households' choice and adoption of livelihood diversification strategies.

To enhance the adoption of household livelihood diversification strategies and to improve the livelihood of the smallholder farmers in the study area as a result, the study recommends the following: (1) government should recognize and support non-farm livelihood diversification strategies as part of the national job creation objectives instead of solely sticking to the inadequate and drought-prone farm income alone; (2) investing in quality education and increasing access to higher education will help the rural households' probability of participation in off-farm and non-farm livelihood diversification activities; (3) access to credit constraints and lack of entrepreneurship skills may have to be addressed via provision of enough credit with lowest interest rate and entrepreneurship skills trainings before farmers engage in non-farm income-generating activities; (4) intensive work on irrigation and making it accessible to smallholder farmers have

paramount importance for getting better income and stable livelihood as response to drought; and (5) expansion of rural–urban road has vital role to link and strengthen the socio-economic liaison and foster development between the rural and urban people.

Abbreviations

TLU: tropical livestock unit; MNL: multinomial logistics.

Authors' contributions

All authors read and approved the final manuscript.

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