Classification and Determinants of Rural Households Participation in Livelihood Diversification Strategies in West Gojjam Zone of Amhara region, northwest Ethiopia

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Abstract

This study investigates the livelihood diversification strategies of rural households and the factors that determine their engagement in these strategies. The study employed Participatory Rural Appraisal (PRA), focus group discussion, and individual in-depth interviews to collect qualitative data. A multistage sampling procedure was used to collect quantitative data from 405 randomly selected rural households. Thematic and narration used for qualitative data analysis. The quantitative data was analyzed using descriptive statistics and a Multivariate probit model. The findings revealed that purpose was a vital criterion in addition to sector, location, and function in classifying rural households' livelihood diversification strategies. On-farm wealth-accumulation strategy, non-farm wealth-accumulation strategy, off-farm survival strategy, non-farm survival self-employment strategy, and non-farm survival wage-employment strategy were categorized. The Multivariate Probit, used for analyzing non-mutually exclusive dependent variables, estimation revealed that male-headed households, commercialization, highland, and midland relative to lowland agro-ecology enhance the rural households' engagement in on-farm wealth- accumulation and non-farm wealth-accumulation livelihood diversification strategies. Landholding size, estimated value of farm and non-farm equipment, the estimated value of crop production increase participation in non-farm wealth-accumulation livelihood diversification strategy while, livestock holding size increased participation in on-farm wealth

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accumulation livelihood diversification strategy. On the other hand, the higher the estimated value of farm and non-farm equipment, the estimated value of crop produced, livestock holding size, and commercialization are associated with the lower the likelihood of participation in off-farm survival, non-farm survival wage-employment, and non-farm survival self-employment livelihood diversification strategies. The findings imply resource endowment and commercialization increase rural households' involvement in wealth-accumulation livelihood diversification strategies. Therefore, policymakers need to focus on the most suitable ways of supporting classified livelihood diversification strategies, thereby enhancing linking agriculture commercialization and diversification of livelihood strategies that induce economic progress.

Keywords: Classification, Commercialization, Determinants, Livelihood diversification strategies, Multivariate probit, Rural households, Survival-oriented, Wealth-accumulation, Rural development

Introduction

Livelihood is a household and community behaviour that manifests itself in the interaction of resource holding and resource use for productive activities for a living (Barrett & Reardon, 2000; Bebbington, 1999; Scoones, 2009). In Ethiopia, agriculture is the dominant livelihood activity using resources of rural households. Agriculture Development Led Industrialization (ADLI) is a long-term economic development policy aimed to transform the economy from agriculture-dominated to industry dominant livelihood (economy). To this effect, the consecutive Plan for Accelerated and Sustained Development to End Poverty (PASDEP), Growth and Transformation Plan (GTP I) and (GTPII) have been focusing on increasing rural households' agricultural production for population food self-sufficiency and marketable surplus for raw materials of manufacturing industries. This creates linkage among agricultural and industrial development sectors,

and leads expansion of on-farm and non-farm livelihood diversification strategies.

Rural households' livelihood diversification strategies are the choices and combinations of livelihood diversification activities that people make to achieve their livelihood goals in addition to primary agricultural activities (DFID, 1999; Hussein & Nelson, 1998; Walelign et al., 2017). These livelihood diversification activities are classified into livelihood diversification strategies. Literature categorizes livelihood diversification strategies as on-farm, off-farm, non-farm, self-employment and wage-employment (Ellis, 1998, 2000; Loison, 2015; Reardon, 1997). These were based on sector, location and function classification criterion (Barrett et al., 2001; Loison, 2015; Woldenhanna & Oskam, 2001), paying little attention to the rural household's purpose of engagement in livelihood diversification strategies. Purpose shows the rural household's aspiration and capability in combining and transforming assets in building of livelihoods (Bebbington, 1999). In other words, purpose indicates the mission that will drive the rural household's engagement in a livelihood diversification strategy i.e., either survival or wealth-accumulation. Cognizant of this fact, livelihood diversification strategies were classified integrating sector, purpose, location and function criteria as: on-farm wealth-accumulation, non-farm wealth-accumulation, off-farm survival, non-farm survival self-employment, and non-farm survival wage-employment.

Rural household livelihood diversification strategies are commonly affected by human, physical, natural, social and financial resource endowments (Ellis, 2000; Gautam & Andersen, 2016; Walelign et al., 2017), and also access to input and output markets and institutional services. Human resource comprises household head sex, age, education, and family size (Abeje et al., 2019; Ali et al., 2016; Deere & Leon, 2003; Ellis, 1999; Walelign et al., 2017). The sex of the head of household influences access to resources and opportunities, and thus could affect engagement in a livelihood diversification strategy

(Akampumuza & Matsuda, 2017; Reardon, 1997; Reardon et al., 2000). Education enhances rural households engagement in skill and knowledge demanding livelihood diversification strategies (Amare & Shiferaw, 2017; Berdegué et al., 2001; Bezu & Holden, 2014; Gautam & Andersen, 2016; Reardon, 1997). Rural households' accessibility of physical resource influences participation in livelihood diversification strategies (Amare & Shiferaw, 2017; Berdegué et al., 2001; Bezu & Holden, 2014). Farmland holding size affects agricultural produce and marketable surplus, affects the capability to engage in diversified livelihood strategies (Woldenhanna & Oskam, 2001). Livestock and crop production are source of cash income influences engagement capital-intensive diversified livelihood strategies (Barrett, et al., 2001; Ellis & Freeman, 2004; Matanyaire, 1997). Access to credit enables households to alleviate liquidity constraint to engage in lucrative livelihood diversification strategies; agricultural extension service on the other hand, enable to adopt technologies improving productivity and marketable surplus (Barrett et al., 2001; Berhane et al., 2018; Dufera, 2018; Ellis, 2000). Agro-ecology is the interaction of soil fertility, rainfall, livestock and crop species, temperature, and other biotic and abiotic factors results various farming systems thereby affects agricultural production and livelihood diversification strategies (Reardon, 1997; Woldehanna, 1997). Crop commercialization is a process that involves producing and marketing commodities demanded by the market, which is strengthening the link between farm and non-farm livelihood strategies (Abebaw et al., 2023; Barrett et al., 2017).

Therefore, understanding the classification and determining factors of rural households' livelihood diversification strategies has the following importance. First, the literature categorizes livelihood strategies as on-farm, off-farm, non-farm, self-employment and wage-employment (Ellis, 1998, 2000; Loison, 2015; Reardon, 1997), based on sector, location and function classification criterion (Barrett, Reardon, et al., 2001; Loison, 2015; Woldenhanna & Oskam, 2001), paying little attention to the rural households purpose of engagement in livelihood

diversification strategies. However, purpose illustrates the aspiration and influence the rural household's combination of resources use to engage in a specific livelihood diversification strategy. Thus, purpose contributes to fill knowledge gap in classifying livelihood diversification strategies. Second, the previous literature focus on theoretical explanations and empirical analysis of factors affecting livelihood diversification strategies however, the nature of livelihood diversification strategies (on-farm wealth-accumulation, non-farm wealth-accumulation, off-farm survival, non-farm survival self-employment, and non-farm survival wage-employment) and its determinants are varied. In addition, there is scant empirical work that analyzes the effect of agro-ecology and commercialization on the choice of livelihood diversification strategies. Therefore, classifying rural households' livelihood diversification strategies considering purpose was innovative criteria on the other hand, understanding the nature of rural households' livelihood diversification strategies and its determining factors, especially its association with agro-ecology and commercialization is supportive for upcoming research and development intervention activities. Therefore, purpose as classification criteria, agroecology and commercialization as determining factors of rural households' livelihood diversification strategies are vital in classifying and understanding determining factors of rural households' livelihood diversification strategies. Thereby, the aims are to fill the knowledge gap in criteria for classifying livelihood diversification strategies and to enable designing a better targeting of policies and programs able to enhance expansion of wealth-accumulation livelihood diversification strategies to fasten economic progress and improve rural households' well-being.

Livelihood diversification strategies: Theoretical framework

Rural livelihoods are the systems of rural household that get a standard of living, whether their livelihoods are secure or at risk over time (Habib et al., 2023). Livelihood diversification is the process by which households construct increasingly diverse livelihood portfolios, making

use of increasingly diverse combinations of resources (Niehof, 2004). The rural households' livelihoods diversification portfolio is the outcome of transforming economies from agriculture dominated to manufacturing industries (Haggblade et al., 2010); and overcoming economic and environmental shocks and stresses. The transforming economies expand non-farm and capital–intensive on-farm livelihood diversification strategies. On the other hand, environmental and economic shocks and stresses negatively affect rural households access to resources; they are forced to engage in survival-oriented livelihood diversification strategies. This is therefore, rural households livelihood diversification is a process rural household's construct a diverse portfolio of activities and social support capabilities in order to survive and improve living standards (Ellis, 1998, 1999). Rural households' livelihood diversification strategies classified as on-farm, off-farm, non-farm, self-employment and wage-employment based on sectoral, location, and functional criteria's of categorization. However, the previous literature fail to consider purpose of engagement as classification criteria though purpose shows mission that will drive the rural household's engagement in a livelihood diversification strategy i.e., either survival or wealth-accumulation. Cognizant of this fact, we tried to classify rural households diversify livelihood strategies integrating sector, purpose, location, and function. Moreover, rural households livelihood diversification strategies are commonly affected by human, physical, natural, social and financial resource endowments (Ellis, 2000; Gautam & Andersen, 2016; Walelign et al., 2017), and also access to input and output markets and institutional services. Therefore, we aim to classify and determine factors of rural households' livelihood diversification strategies that are able to contribute in filling knowledge gap in classifying livelihood diversification strategies. Further, we aim to understand the different determining factors that would enable developing policies and programs tailored to the rural households social and economic reality, thereby induce economic progress and improve the households' well-being.

Methodology

Study area

West Gojjam zone is located in Amhara Region, northwestern Ethiopia. It is administering fourteen woredas (districts) and six town administrations. West Gojjam zone population is 2755600, of which 1383472 is male and 1372128 is female (CSA, 2023). The study area was selected for several reasons. First, it covers a large area (13311.94 square km) and has a wide range of agro-ecological classifications. The elevation ranges from 684 to 3656 masl[4](West Gojjam zone plan commission report, 2022), which enables rural households to produce diversified crop and livestock species. Production comprises predominantly cereal, horticulture and pulse crops (Amede et al. (2017). The cultivated farmland size is estimated to be 612297 hectare (CSA, 2014) and livestock production comprises predominantly cattle, sheep, goats, equines, and poultry species (CSA, 2021). Second, rural households engage in diversified livelihood activities to support their household's well-being. On-farm, off-farm, and non-farm livelihood diversification activities are practiced in the study area (Tizazu et al., 2018). On-farm livelihood diversification activities are beekeeping, poultry, and *Khat* production. Off-farm livelihood diversification activities are agricultural wage labor, migration for agricultural wage labor, charcoal production, and firewood collection. Non-farm livelihood diversification activities are blacksmith, weaving, pottery, mat and basket making, local brewery *(Tela and Katikala)*, wage employment in construction works, carpentry, cementing, masonry, metalwork, and woodwork, livestock fattening and trading, crop and livestock trade, petty trade, animal cart transport service, renting house in urban centers and employment in government institutions. Third, there is availability of several supporting institutions such as Amhara Region Bureau of Labour and Skills, Technical and Vocational Education and Training (TVET), Agricultural Technical and

[4] meter above sea level

Vocational Training (ATVET), and Amhara Credit and Saving Institute (ACSI). The support institutions are responsible in organizing youth and households, providing theoretical and practical training, managing revolving funds and providing credit service for youth and rural households engaging in diversified livelihood activities.

Research design

This study employs a mixed research design that combines both quantitative and qualitative research approaches. Mixed research design used for triangulation and complementarity (Creswell, 2009; Greene et al., 1989). Triangulation involves using multiple methods to seek convergence of research findings, while complementarity aims to understand different components or phenomena of the study.

Qualitative data collection

The qualitative research approach is used to identify and characterize livelihood diversification activities, and then categorize and characterize the rural households' livelihood diversification strategies. Participatory Rural Appraisal (PRA), Focus Group Discussion (FGD), and in-depth interview are used because, they enable to identify complex portfolio of livelihood diversification activities and then, combines into livelihood diversification strategies (Al-Qubatee et al., 2017; Ali & Delisle, 1999; Chambers, 1994a, 1994b). First, identifying and characterizing rural households' livelihood diversification activities were done using PRA, FGD, and in-depth interviews. PRA was conducted with four experts of districts' micro and small enterprise development offices, visiting six livelihood diversification activities supported by the small and medium enterprise development offices of respective districts, and discussing with experts and researchers identifying important rural households' livelihood diversification activities. Five Focus Group Discussions (FGD) were done with eight to ten participants rural households in each FGDs in the two districts.

Three individual in-depth interviews were done with two experts working in Burie and Dembecha district agriculture offices and one expert working in small and medium enterprise development offices in the west Gojjam zone. Moreover, researchers' observations during the transect walk were used to identify livelihood diversification activities. Second, PRA participants, focus group discussants, and in-depth interviewees identified purpose, sector, location, and function criteria for categorizing livelihood diversification strategies. Integrating such criterion, the PRA participants, focus group discussants, and individual interviewees' identify and combine diversified livelihood activities in to categories of livelihood diversification strategies such as: on-farm wealth-accumulation livelihood diversification strategy, non-farm wealth-accumulation livelihood diversification strategy, off-farm livelihood diversification strategy, non-farm self-employment livelihood diversification strategy and non-farm wage-employment livelihood diversification strategy were classified. Then, there was selection and combining of livelihood diversification activities into categories of the livelihood diversification strategies. Characterizing each rural household's livelihood diversification strategies was important for understanding the worthiness of these classifications. Discussions and interviews were guided by key questions, including: *What are rural households diversified livelihood activities? What human, physical, social, financial, and natural capital and others are needed to sustain each diversified livelihood activity? Why do households choose to participate or not in each diversified livelihood activity? What are the expected outcome of these livelihood diversification activities? What is the purpose of engagement in livelihood diversification activities?* Moreover, clarifying questions were posed throughout the PRA, FGD and individual in-depth interview process to ensure understanding without influencing group dynamics or individual opinions.

Sampling procedure and data collection

The quantitative data was collected using a structured questionnaire. Four hundred and five (405) sample respondents were selected using a multi-stage sampling procedure. First-stage, among the fourteen districts administered in the west Gojjam zone, Dembecha Zuria and Burie Zuria were selected using lottery method. Second Stage: Kebele lists in each district were clustered based on agro-ecological zones: lowland, midland, and highland. Then, Zeyushewen, Wadera, and Ambaye from Burie district and Astevoch-Egziabhierab, Yesheboch, and Gelila from Dembecha district were selected using the lottery method. Finally, the proportion-to-size sampling procedure used to sample 405 respondents. Cochrane sample size determination formula provides the maximum size to ensure the desired precision, in the case of large populations and unknown variability of rural households' diversifying livelihood strategies (Israel, 1992). The formula provides 385 sampled households but to alleviate the problem of households missing data, we added 20 sampled households for a total sample of households being 405.

$$n_0 = \frac{z^2 pq}{e^2} \qquad \text{[Equation 1]}$$

Where: z is 1.96, p is the estimated proportion of the population who is diversifying livelihood strategies (0.5) q= (1- p) =0.5 and e is the precision level (0.05).

Moreover, we developed a structured questionnaire and pre-tested to tailor it to the local situation. Finally, quantitative data was collected on rural households' livelihood diversification strategies, socio-demographic characteristics, human, natural, physical, financial, and social capital, agro-ecology, crop production, and access to market and support institution services.

Data analysis

The qualitative data analysis was done using thematic content analysis on the informal discussions, transcripts, and field notes data. The

researchers familiarized with the data through reading the transcripts and then, the data was coded into major themes, after which these were grouped into categories of similar ideas. Moreover, in the field, the researcher, PRA participants, focus group discussants, and in-depth interviewees identified and grouped rural households' livelihood diversification activities. The participants selected and combined livelihood diversification activities based on sector, purpose, location, and function as on-farm and non-farm; survival or wealth-accumulation; on-farm and off-farm; and wage employment and self-employment., respectively. Then after, integrating sector, purpose, location, and function classification criterion, PRA participants, the focus group discussants, and individual interviewees clustered and characterized the number of livelihood diversification activities into: on-farm wealth-accumulation livelihood diversification strategy; non-farm wealth-accumulation livelihood diversification strategy; off-farm livelihood diversification strategy; non-farm survival wage-employment livelihood diversification strategy; and non-farm survival self-employment livelihood diversification strategy. Narrative analysis was used to explain the characteristics of each livelihood diversification strategy. Quantitative data analysis was done using descriptive statistics such as mean, proportion, and standard deviation, and the Multivariate Probit econometric model.

Classification of livelihood diversification strategies

The literature categorizes livelihood strategies as on-farm, off-farm, or non-farm (Ellis, 1998, 2000; Loison, 2015; Reardon, 1997). On-farm consists of crop and livestock production. Off-farm comprises wage or exchange labor on other farms in agricultural production, firewood collection, and charcoal production. Non-farm economic activities include manufacturing and service activities not related to primary agricultural commodity production. These classifications are based on criteria such as sector, location, and function (Barrett et al., 2001; Loison, 2015; Reardon, 1997). The purpose was also identified as an

important factor in categorizing livelihood diversification strategies. Participants defined survival as the practice of diversifying livelihood activities to meet subsistence needs, while wealth-accumulation refers to efforts aimed at improving livelihood standards.

Purpose was found to be an important factor in classifying livelihood diversification strategies in addition to sector, location, and function. PRA, focus group discussions, and individual interviews define livelihood diversification activity as rural household members participating in a livelihood diversification activity other than conventional crop and livestock mixed farming[5]. The participants and researchers identified purpose as a criterion for categorizing livelihood diversification strategies. Because rural households diversify their livelihood activities to meet either subsistence demand or to improve living standard. The participants defined survival as a rural household's practice of diversifying livelihood activities to meet subsistence demand whereas wealth-accumulation is rural household's practice of diversifying livelihood activities to improve living standards. This implies purpose is to demonstrate the motivation and aspiration of rural households to engage in a livelihood diversification activity. Additionally, the sector takes into account on-farm and non-farm livelihood diversification activities, whereas location takes into account off-farm livelihood diversification activities, and function comprises self-employment and wage-employment in non-farm livelihood diversification activities. Therefore, considering purpose, sector, location, and function criterion, PRA, focus group discussions, and in-

[5] Rural household's livelihood diversification activities are livelihood activities other than the common crop (cereal and pulse) and livestock (cattle, equine, goat and sheep)production (livelihood) activities. Because, first, rural households engage in diversified livelihood activities to generate additional income while facing food deficiency (the purpose of engagement is achieving food self-sufficiency); second, the rural households engage in wealth accumulation livelihood diversification activities, in this case, the household do not have problem of food self-sufficiency rather need to accumulate wealth through saving and investing in remunerative livelihood diversification activities. Based on these arguments, we use livelihood diversification activities instead of using livelihood activities, in a similar way; we are using livelihood diversification strategies.

depth interview classified and characterized on-farm wealth-accumulation livelihood diversification strategy, non-farm wealth-accumulation livelihood diversification strategy, off-farm survival livelihood diversification strategy, non-farm survival self-employment livelihood diversification strategy, and non-farm survival wage-employment livelihood diversification strategy. This process involved selecting, characterizing, and combining portfolios of activities into coherent categories that reflect the strategies employed by rural households.

Application of multivariate probit regression

The multivariate probit model is used to investigate the factors that influence the selection of livelihood diversification strategies. In previous research, the Multinomial Logit model, which assumes that rural households livelihood diversification strategies are mutually exclusive, was used to examine the determinants of livelihood diversification strategies (Bezu & Holden, 2014; Gebru et al., 2018; Matsumoto et al., 2006). However, rural households may use multiple livelihood diversification strategies; thus, a multivariate probit model is used to examine the factors that influence rural households' choice of livelihood diversification strategies. Because multivariate probit uses maximum likelihood to estimate probit regression parameters and the probabilities of livelihood diversification strategy combinations (Bock & Gibbons, 1996). Furthermore, multivariate accommodates linear and non-linear relationships, and the magnitude of the covariate's effect is dependent on the status of the covariant and the magnitude of the estimator coefficient (Hill & Kau, 1973). This is consistent with various economic theories, such as the theory of economic scale. For instance, the percentage change in resource endowment- specified as household landholding size - affects the household's initial resource endowment. Thus, multivariate probit was used to investigate the factors that influence rural households' choice of livelihood diversification

strategies.

Multivariate probit is specified (Chib and Greenberg, 1998; Hill and Kau, 1973) as:

$y_i = 1 \quad if \beta_i x_i + \varepsilon_i > 0$ [Equation 2]

$y_i = 0 \quad if \beta_i x_i + \varepsilon_i \geq 0 \quad i = 1, 2, 3, 4, 5$ [Equation 3]

Where $y_i$is choice of livelihood diversification strategies such as: on-farm wealth accumulation livelihood diversification strategy, non-farm wealth accumulation livelihood diversification strategy, off-farm survival livelihood diversification strategy, non-farm survival self-employment livelihood diversification strategy, and non-farm survival wage-employment livelihood diversification strategy. If the rural household engage in a livelihood diversification strategy it is one (1), otherwise zero.

X_i is a vector of explanatory variables.

$\beta_1 \beta_2 \ \beta_3 \ \beta_4 \beta_5$ are parameter vectors.

$\varepsilon_1 \varepsilon_2 \varepsilon_3 \varepsilon_4 \varepsilon_5$ are random errors distributed as a multivariate normal distribution with zero mean, unitary variance and $n \quad x \quad n$ correlation matrix.

Hypothesized determinants of choice of livelihood diversification strategies

Based on a review of previous studies, several variables are hypothesized to affect the choice of livelihood diversification strategies among rural households.

Sex of Household Head: This influences access to resources and opportunities (Abeje et al., 2019; Ali et al., 2016; Deere & Leon, 2003; Ellis, 1999; Walelign et al., 2017). Evidence indicates that female-headed households often have limited access to better landholding size, leading to participation in labor-intensive, low-skill, low-entry-barrier livelihood diversification strategies (Akampumuza and Matsuda, 2017; Reardon, 1997; Reardon et al., 2000).

Age of Household Head: Associated with farming experience and resource access, older household heads may enhance their skills and knowledge about agricultural practices, improving productivity, and income which facilitates entry in to more lucrative livelihood diversification strategies

Household Head Education: Higher education levels increase the skills and knowledge required for engaging in profitable livelihood diversification strategies (Amare & Shiferaw, 2017; Berdegué et al., 2001; Bezu & Holden, 2014; Gautam & Andersen, 2016; Reardon, 1997).

Household Family Size: Larger families may increase food consumption, thereby reducing marketable surplus. Evidence suggests that households with larger family sizes tend to engage in less capital-intensive livelihood diversification strategies (Abeje et al., 2019; Woldenhanna & Oskam, 2001)

Physical Capital: This includes both farm and non-farm equipment. Higher levels of physical capital enable households to engage in more lucrative non-farm livelihood diversification strategies (Amare & Shiferaw, 2017; Berdegué et al., 2001; Bezu & Holden, 2014).

Land Holding Size and Farmland Fragmentation: Larger landholdings generally lead to higher production and income, thus participation in wealth –accumulation livelihood diversification strategies (Woldenhanna & Oskam, 2001). Conversely, farmland fragmentation may hinder economic causes economic efficiency (Manjunatha et al., 2013; Todorova & Lucheva, 2005).

Financial Capital: Financial resources are critical for engaging in profitable livelihood diversification strategies. Livestock and crop production provide monetary income, influencing participation in wealth-accumulation livelihood diversification strategies (Barrett et al., 2001; Ellis & Freeman, 2004; Matanyaire, 1997).

Distance to Rural Towns and All-Weather Roads: Proximity to towns facilitates input and output linkages among livelihood strategies, while access to all-wealth roads enhances participation in wealth-accumulation livelihood diversification strategies.

Access to Institutional Services: Access to credit and agricultural extension services aids in overcoming entry barriers to profitable strategies. Access to credit services liquidity constraint to engage in remunerative livelihood diversification strategies (Barrett et al., 2001; Ellis, 2000). Agricultural extension service is critical for encouraging the adoption of improved technologies, increase productivity and income, as well as a means of promoting rural development and economic transformation (Berhane et al., 2018; Dufera, 2018).

Social Capital: Network of relatives, friends, community members provide essential resources, knowledge, and skill for engaging in wealth-accumulation livelihood diversification strategies (Mumuni & Oladele, 2016; Reardon, 1997).

Agro-ecology: It is the interaction of environmental factors affecting productivity and livelihood diversification strategies. (Reardon, 1997; Woldehanna, 1997).

Crop Commercialization: It strengthens the link between farm and non-farm livelihood strategies, enhancing economic growth and enabling households to engage in more capital-intensive livelihood diversification strategies (Barrett et al., 2017). The crop commercialization is measured as the ratio of crop value marketed to crop value produced in a given production year (Alemu et al., 2006; Bekele & Alemu, 2015; Strasberg et al., 1999; von Braun & Kennedy, 1994).

$$Outputcommercialization = \frac{Value\ of crop\ sales}{Value\ of crops\ produced}$$

$$Outputcomm_i = \frac{\sum_{j=1}^{k} P_j S_{ij}}{\sum_{j}^{k} P_j C_{ij}} \qquad \text{[Equation 4]}$$

Where;
$Outputcomm_i$ is the level of commercialization of household 'i'
P_j is the average price of crop 'j'
S_{ij} is the amount sold by the household 'i' of crop 'j', where j ranges from 1 to k
C_{ij} is the total volume of crop 'j' produced by household 'i'

Result and Discussion

Descriptive summary statistics

The thematic and narrative analysis identified five livelihood diversification strategies. As presented in Table 1, among the sampled rural households 61.7%, 23.5%, 11.6%, 5.4% and 33.1% engaged in on-farm wealth-accumulation, off-farm survival, on-farm survival self-employment, non-farm survival wage-employment, and non-farm wealth-accumulation livelihood diversification strategies, respectively. The average family size in the sampled households was around 5.4. The average estimated value of farm and non-farm equipment in rural households was 16684.55 (ETB[6]). The average landholding size of the sampled households was 1.22 hectares, ranging from having no landholding to farmers owning four hectares. The average farmland fragmentation index was 0.565, with values ranging from having a parcel of farmland to having highly fragmented farmland (0.875). The sampled households' residence walking distance to the nearest town takes an average of 42 minutes, ranging from 33 to 180 minutes. The average time taken to travel from the sampled households' homes to the all-weather roads was around 39 minutes, with a minimum of 25 and a maximum of 600 minutes. The average commercialization index of the sampled households was 0.228, ranging from rural households who have not marketed any of the crops produced to marketing 98.7percent of the crop produced, in a production year. These statistics highlight the

[6] ETB is Ethiopian Birr(currency)

diverse livelihood strategies and varying resource endowments among rural households, which are crucial for understanding their economic resilience and development potential.

Table 1: Descriptive summary statistics

Category	*Variable*	*Obs*	*Mean/proportion*	*Std. Dev.*	*Min*	*Max*
Livelihood diversification strategies	On-farm wealth-accumulation (dummy; 1 engage in; 0 otherwise)	405	0.617	0.487	0	1
	Non-farm wealth-accumulation (dummy; 1 engage in; 0 otherwise)	405	0.331	0.471	0	1
	off-farm survival (dummy; 1 engage in; 0 otherwise)	405	0.235	0.424	0	1
	Non-farm survival self- employment (dummy; 1 engage in; 0 otherwise)	405	0.116	0.321	0	1
	Non-farm survival wage- employment (dummy; 1 engage in; 0 otherwise)	405	0.054	0.227	0	1
Human capital	Household head sex (1 male,0 otherwise)	405	0.901	0.299	0	1
	Household head age (continuous)	405	47.583	12.406	25	83
	Household head education (continuous)	404	1.233	2.176	0	12
	Household family size (continuous)	405	5.417	1.941	1	11
Physical capital	Farm and non-farm equipment estimated value in Ethiopian Birr (continuous)	404	16684	50373.55	0	383600
Natural capital	Landholding size in hectares (continuous)	405	1.226	0.821	0	4
	Farmland fragmentation index (continuous)	376	0.565	0.232	0	0.875
Financial capital	Crop produced value in Ethiopian Birr (continuous)	398	67318.3	77223.54	0	537000
	Livestock size in TLU (continuous)	404	3.931	2.671	0	17.16
Social capital	Relative living abroad (dummy; 1 yes; 0 otherwise)	405	0.069	0.254	0	1
Market access	Distance from the nearby town (continuous)	405	42.486	33.206	1	180
	Distance from the all-weather road in minute (continuous)	405	39.070	25.649	0	600
Support capabilities	Access to credit service (dummy; 1 accessed; 0 otherwise)	402	0.508	0.501	0	1
	Access to extension service (dummy; 1 accessed; 0 otherwise)	402	0.861	0.347	0	1
Commercialization	Output commercialization index (continuous)	396	0.228	0.220	0	0.987
Agro-ecology	Highland agro-ecology (dummy; 1 highland;0 otherwise)	405	0.425	0.495	0	1
	Midland agro-ecology (dummy; 1 midland; 0 otherwise)	405	0.264	0.442	0	1
	Lowland agro-ecology (dummy; 1 lowland; 0 otherwise)	405	0.311	0.464	0	1
District	Woreda (dummy; 1 Dembecha; 0 Burie)	405	0.524	0.500	0	1

N.B Observation(n) variation is due to unit non-response, the data is missed completely at random (MCAR) and also it is less than 10 percent of the sample size 385, thereby represents the population. Thus, "list-wise deletion" of missing data and the "complete-case analysis" lead to unbiased parameter estimates (De Leeuw et al., 2003; Howell, 2007; Kang, 2013; Little, 1988; Pampaka et al., 2016).

Source: own survey

Classification and characterization of livelihood diversification strategies

Purpose in addition to sector, location, and function was found to be an important factor in classifying livelihood diversification. Participatory rural appraisal, focus group discussions, and individual interviews define livelihood diversification as rural household members participating in a livelihood activity other than conventional crop and livestock mixed production system. The PRA, focus group discussions, and in-depth interview identifies 'purpose' as a criterion for categorizing livelihood diversification strategies, because rural households diversify their livelihood activities to meet either subsistence demand or to improve their living standard. Survival is about diversifying livelihood strategies to meet subsistence demand whereas wealth-accumulation is diversifying livelihood activities in order to improve living standards. The purpose is to demonstrate the motivation of rural households to engage in a livelihood diversification activity. As a result, participants in the PRA, focus group discussion, and in-depth interviewees investigated and combined rural households' livelihood diversification activities into livelihood diversification strategies classified integrating purpose, sector, location, and function criteria. Sector considers farm and non-farm livelihood diversification activities, whereas location considers off-farm livelihood diversification activities; and function comprises self-employment and wage-employment in non-farm livelihood diversification activities. Thereby, five livelihood diversification strategies such as on-farm wealth-accumulation livelihood diversification, non-farm wealth-accumulation livelihood diversification, off-farm survival livelihood diversification, non-farm survival self-employment livelihood diversification, and non-farm survival wage-employment livelihood diversification were classified. Similarly, Al-Qubatee et al.(2017), Ali & Delisle (1999), Chambers (1994a;1994b) state that PRA, focus group discussion, and in-depth interview assists rural households in identifying and characterizing

livelihood activities, as well as developing criteria for categorization; this combines a complex portfolio of activities into livelihood diversification strategies (Scoones, 2009).

(1) On-farm wealth-accumulation livelihood diversification strategy. Here marketed surplus and selling livestock species are the main sources of income for those who engage in on-farm wealth-accumulation livelihood diversification strategy. On-farm livelihood activities such as livestock fattening, beekeeping, poultry, and *Khat* production[12] are part of the livelihood strategy. These are remunerative livelihood activities rural households participate to increase their income and wealth. The livelihood activities necessitate a large initial investment in order to purchase chicken, build poultry and honeybee houses, purchase beehives, and establish a honeybee colony. Natural and physical capital, such as farmland, irrigation reservoirs, motor pumps, irrigation canals, farming equipment, and housing, are required for livelihood diversification activities; human capital such as skilled labour for production intensification and access to input and output markets is needed. Egg, chicken, *khat*, honeybee colony, and honey are the products. Rural households earn money by selling their produce. The primary goal of engaging rural households in diversification is to increase their wealth. These rural households are better off by engaging in on-farm wealth-accumulation livelihoods.

[12] Beekeeping contributes to household income and poverty alleviation (Fikru, 2015); *Khat* and Poultry production is essential source of income for smallholder farmers (Cochrane and O'Regan, 2016; FAO, 2019).

(2) Diversification strategy. The rural household participated in this livelihood diversification strategy states that they do so for the purpose of *"lelejochachin terit benetewelachew belen new,"* which translates as "we need to accumulate wealth for the livelihood wellbeing of our children after we die." This is a livelihood strategy used by 61.73 percent of the sampled households.

(3) Non-farm wealth-accumulation livelihood diversification strategy encompasses livelihood activities such as crop and livestock trade, petty trade, owning animal cart and providing transport service, owning and renting a house in urban centres and employment in government institutions. This strategy of livelihood diversification necessitates skill and knowledge of fattening practices, crop storage, and crop and livestock marketing and demands high start-up and running capital. Physical resources include a house, weighing machine, livestock barn, and storage facility; human capital includes knowledge of fattening practices, business management, and a network of input and output traders. In comparison to other methods of income diversification, the investment return is high. Similarly, skilled non-farm and full-time income strategies outperform (Barrett et al., 2005). The rural households that participated in this livelihood diversification strategy were known as "better-off" rural households. They participate in a non-farm wealth-accumulation livelihood diversification strategy to accumulate wealth for social security, at the time of livelihood retirement age and for the livelihood wellbeing of their children. Among the sampled households, 33.09 % are better-off rural households who engage in non-farm wealth-accumulation livelihood diversification strategy.

(4) Off-farm survival livelihood diversification strategy included agricultural wage labour, migration for agricultural wage labour, charcoal production, and firewood collection activities. These livelihood diversification activities necessitate unskilled labour and low capital investment, and the return is low. Wage-employed workers work in crop cultivation, particularly during the planting and harvesting seasons, when labour demand is high. Workers are poor and work in better-off farmer farms during crop planting and

harvesting seasons, migrating from highlands (where labour is plentiful) to lowlands (where labour is scarce). During the planting season, wage labourers plant their farms early and migrate to the lowlands, and then return to manage their crop-cultivated farm. Similarly, during the harvesting season, labourers migrate to the lowlands to earn a living and then return to their home to harvest their crop. It is seasonal work as wage labour in other agricultural farms (Barrett et al., 2001; Reddy et al., 2014). In comparison to other livelihood diversification strategies, this one requires less capital (for example, transportation costs). The rural households that participated in this livelihood diversification strategy were identified as "poor" and work for *"beleto lemader,"* which translates as "meeting subsistence food demand." These rural households do not produce enough agricultural products to meet their household consumption demand, so they engage in this livelihood diversification strategy to meet their household's food and non-food consumption demand. About 23.5 percent of the sampled households practice off-farm survival livelihood diversification.

(5) Non-farm survival self-employment livelihood diversification strategy includes rural traditional livelihood activities such as handicraft works such as blacksmith, weaving, pottery, mat, baskets and local brewery (*Tela and Katikala*). The survival strategy necessitates intensive labour and little physical capital. Handicraft production requires equipment such as weaving machines, pottery, and other miscellaneous materials. Indigenous knowledge and skills learned from parents and the community are essential for producing handicrafts. The products have market demand and development potential; however, there is a lack of skill and knowledge used to improve the quality of the goods and market the products. As a result, the return on investment for non-farm survival self-employment is low. This livelihood diversification strategy aims to meet household food and non-food consumption demand. About 11.6 percent of the sampled households used a non-farm survival self-employment livelihood diversification strategy.

(6) Non-farm survival wage-employment livelihood diversification strategy includes wage employment in construction works, carpentry, cementing, masonry, metalwork, and woodwork, among other things. These require skilled labour and are in rural towns as well as urban areas. In recent years, this livelihood diversification strategy has grown in popularity. Rural households participate in livelihood diversification activities in nearby rural towns and urban centres. Farm household members work for a wage. Skilled labour is required for livelihood diversification activities. Most of the workers are youth who attend primary, secondary, technical and vocational schools. After a lengthy apprenticeship, wage-employed workers learn on-the-job skills during their work (Woldehanna, 1997). Because of a lack of job opportunities for youth, there is more surplus labour, which undervalues the work of wage-employed workers. The wage income is then low. Rural households participate in this livelihood diversification strategy must meet the household's food and non-food consumption demands. 5.43 percent of the sampled households engage in a non-farm wage-employment livelihood diversification strategy.

These categorizations and characterisations of livelihood diversification strategies demonstrate the extent to which rural households consider the purpose of livelihood diversification strategies in their engagement decision. Participants of off-farm survival, non-farm survival self-employment and non-farm survival wage-employment livelihood diversification livelihood strategies stated that the motivation for their participation is *"beleto lemader,"* which translates as "meeting subsistence food demand," which is a survival purpose. The participants are poor, and the goal of the engagement is to generate additional income to meet household subsistence food and non-food consumption demand; in other words, the goal of the engagement is survival. Similarly, the rural poor diversify their livelihoods to low-return non-farm livelihood diversification strategies, contributing insignificantly to well-being (Gautam & Andersen, 2016; Haggblade et al., 2010). As a result, the poor rural households' goal is to meet subsistence demand, i.e., to survive. On the other hand, rural households engaged in on-farm and non-farm wealth accumulation livelihood strategy state that "*lelejochachin terit*

benetewelachew belen new" translated as: "we need to accumulate wealth for our children's sustainable livelihood wellbeing" suggests rural households engage in a livelihood diversification strategy to accumulate wealth. Furthermore, participants in on-farm wealth accumulation and non-farm wealth-accumulation livelihood diversification strategies referred as *"habtamoch,"* which translates as "better-off" rural households. Similarly, better-off rural households diversify not for survival but for wealth accumulation, so that they can engage in profitable livelihood diversification strategies (Gautam & Andersen, 2016; Woldenhanna & Oskam, 2001). As a result, the goal of better-off rural households is to accumulate wealth and improve living standards. The motivation is to achieve social security at the time of livelihood retire age, as well as children's sustainable livelihood well-being during their parent's illness. As a result, we can conclude that the purpose of livelihood diversification for poor rural households is survival, whereas the purpose of livelihood diversification for better-off smallholder farmers is wealth accumulation. This is in line with the empirical work of (Gautam & Andersen, 2016).

Determinants of livelihood diversification strategies: estimates of multivariate probit

Before estimating the multivariate probit regression, diagnostic tests such as multicollinearity, heteroscedasticity, and omitted variable tests were performed. The Variable Inflation Factor (VIF) test shows there is no multicollinearity between covariates. The Breusch-pagan/Cook-Weisberg test shows that there was not heteroscedasticity (chi-square, 60.67 and p=0.132). The omitted variable test shows that there is no omitted variable (P=0.195). In addition, pseudo R^2 implies that 360 (88.89 %) of the 405 sampled households included in the model are correctly estimated.

Table 2 depicts how the sex, age, and education of household heads have an impact on the choice of livelihood diversification strategies. Men-headed households are more likely to engage in on-farm wealth-accumulation and non-farm wealth-accumulation strategies, relative to women-headed households. This is because men-headed households have better asset access to use to engage in resource-demanding and high-return livelihood

diversification strategies, in comparison with women-headed households (Abeje et al., 2019). Men-headed households engage in off-farm survival strategy. The qualitative analysis characterized off-farm survival strategy as wage-employment in other farmers' farm activities. In other words, there is migration of men from the highlands to work in commercial farms in the lowlands (where labor is scarce), in which women are not encouraged to participate, suggests that it is a livelihood diversification strategy that engages men in comparison to women.

As expected, household head age limits rural households' participation in off-farm survival and non-farm survival self-employment strategies. Because the increment in the household head age enhances access to resources use to engage in remunerative livelihood diversification strategies (Bezu & Holden (2014). Moreover, PRA participants, FGDs and In-depth interviewee point out that the elder household heads have better farmland holding size and other physical assets, and these limit rural households' participation in survival-oriented strategies.

Household head education increases household participation in non-farm survival wage-employment strategy because the business owners recruit educated individuals for the success of the business. Similarly, minimum level of formal education is required for working in non-farm survival wage-employment livelihood diversification strategy (Canagarajah et al., 2001).

The estimated value of owned farm and non-farm equipment encourages rural households' probability of participation in non-farm wealth-accumulation strategy, while limiting probability of participation in off-farm survival strategy. Because physical assets enable rural households participation in remunerative non-farm livelihood strategies (Adi, 2005; Khatun & Roy, 2012; Reardon et al., 2001). On the other hand, off-farm survival strategy needs less physical resources and has low return. Thus, rural households having better physical assets are discouraged participation in off-farm survival strategy comparing with households having less physical resources. Therefore, physical resources increase participation in non-farm wealth-accumulation strategy otherwise, limits participation in off-farm

survival strategy.

Rural households' increasing landholding size encourages rural households to engage in non-farm wealth-accumulation strategy. According to comparable empirical evidence, farmland-rich rural households engage in remunerative livelihood activities (Barrett et al., 2005). Larger landholding sizes may produce a marketable surplus to generate cash income, thereby used to engage in capital-intensive non-farm wealth-accumulation strategy.

Estimated value of crop production boosts rural households' participation in non-farm wealth-accumulation livelihood diversification strategy. The reason for this could be crop production increases the financial capacity (income) of rural households. As a result, rural households may be able to invest in high-risk start-up capital-demanding non-farm wealth-accumulation livelihood diversification strategy. This is consistent with rural households earning more money from crop production and diversifying their income through alternative income-generating activities (Block & Webb, 2001). Rural households' livestock holding size improves participation in on-farm wealth-accumulation strategy while limiting participation in off-farm survival strategy and non-farm survival wage-employment strategy. Livestock, a source of cash income, may alleviate rural households' liquidity constraints for purchasing farm equipment such as motor pumps, house construction, bees and beehives, and *khat* planting materials for on-farm wealth-accumulation livelihood diversification strategy. Rural households having better livestock holding size had limited participation in off-farm survival and non-farm survival wage-employment strategies in comparison with households having less livestock holding size. The probable reason is the survival-oriented strategies are less lucrative livelihood diversification strategies, which are not preferable in comparison wealth-accumulation strategies.

Rural households' relatives living in abroad are pursuing non-farm wealth-accumulation strategy. Rural households, who have extended kinship abroad, secure income from various sources such as remittances (Ellis, 2000; Smith et al., 2001). Then, non-migrant rural households who receive remittance, are able to access education and financial capital to be used to engage in non-

farm wealth-accumulation livelihood diversification strategy.

The rural households' residence distance from town increases their chances of participating in a non-farm survival wage-employment strategy. As the focus group participants and in-depth interviewees explain, this allows household members, particularly youth from the highlands, to migrate to work in rural towns and urban centers, where non-farm livelihood diversification strategies are expanding. Because in the highlands, the agricultural productivity and production was less in comparison with the midlands and lowlands, forcing the household members search for wage-employment livelihood diversification strategies in the towns.

Output commercialization increased rural households' participation in on-farm and non-farm wealth-accumulation strategies. On the other hand, the higher the commercialization of rural households, the less likely they participate in non-farm survival self-employment in comparison with less commercialized rural households. Because commercialized rural households have access to financial capital, they can overcome entry barriers and participate in wealth-accumulation strategy. Similarly, access to financial capital enable to overcome entry barriers to engage in profitable livelihood diversification strategies (Barrett et al., 2001; Ellis, 2000; Gautam and Andersen, 2016). Therefore, the higher commercialization of rural households gives advantage to participate in wealth-accumulation strategies while limiting engagement in non-farm survival self-employment strategy in comparison with less commercialized rural households.

In comparison to their lowland counterparts, rural households in the highlands engage in on-farm wealth-accumulation, non-farm survival wage-employment, and non-farm wealth-accumulation strategies. Furthermore, midland rural households engage in more on-farm wealth accumulation, non-farm survival wage-employment, and non-farm wealth accumulation livelihood diversification strategies than lowland farmers. Because, in comparison to the lowlands, the highland and midland agro-ecology is characterized by population pressure and severe land degradation (Zaitchik

et al., 2012); and then crop production and marketability varies accordingly (Amare et al., 2018). Consequently, the rural households in the highlands and midlands diversify livelihood strategies in comparison with the lowlands. Moreover, the PRA participants, focus group discussants, and in-depth interviewees stated that the household members in the highland and midland agro-ecologies participate in diversified livelihood strategies. In a household, younger youths engage in non-farm survival wage-employment livelihood diversification strategy (wage-employment in construction works, carpentry, cementing, masonry, metalwork, and woodwork, among other things) while older youths engage in on-farm and non-farm wealth-accumulation strategies. Because the younger youths have only labor whereas, older youths have saved money gained from non-farm survival wage-employment strategy and then, can use the accumulated money to invest in capital-intensive on-farm and non-farm wealth-accumulation strategies. On the other hand, rural households in the lowlands outperform those in the highlands and midlands in terms of agricultural production because of its agro-ecological advantage in agriculture production potential. Hence, the lowland rural household members spent most of their time engaging in crop and livestock production. Similarly, better potential areas in agricultural production mainly rely on crop and livestock production rather than diversifying to non-farm livelihood strategies (Adi, 2005). Therefore, the rural households in highlands and midlands diversify their livelihood strategies relative to lowlands. Finally, yet importantly, rural households in Dembecha woreda, as opposed to Burie woreda, practice a non-farm wealth-accumulation livelihood diversification strategy.

Table 2: Multivariate probit estimates of rural households' livelihood diversification strategies

Access to resources	*Explanatory variables*	*On-farm wealth accumulation*	*Non-farm wealth accumulation*	*Off-farm survival*	*Non-farm survival self- employment*	*Non-farm survival wage- employment*
Human capital	Household head sex (dummy=1 male,0 otherwise)	0.588**(0.257)	0.803**(0.350)	0.563*(0.303)	-0.148(0.359)	0.024(0.476)
	Household head age (continuous)	-0.003(0.007)	-0.003 (0.007)	-0.029***(0.008)	-0.029***(0.011)	-0.006 (0.013)
	Household head education (continuous)	-0.018(0.037)	0.052(0.038)	0.006(0.041)	-0.135(0.084)	0.108**(0.051)
	Household family size (continuous)	0.033(0.044)	-0.039(0.048)	0.098*(0.053)	-0.111(0.08)	0.103(0.076)
Physical capital	Farm and non-farm equipment estimated value (continuous)	9.48e-07(1.55e-06)	1.27e-05***(2.84e-06)	-5.28e-06*(3.04e-06)	-9.42e-08(2.98e-06)	-1.79e-05(1.75e-05)
Natural capital	Landholding size in hectares (continuous)	0.115(0.126)	0.235*(0.137)	0.054(0.158)	-0.120(0.236)	0.227(0.216)
	Farmland fragmentation index (continuous)	-0.387(0.350)	0.072(0.386)	-0.048(0.394)	-0.716(0.518)	0.195(0.628)
Financial capital	Crop produced value (continuous)	8.95e-08(1.14e-06)	2.26e-06*(1.21e-06)	-3.99e-06**(1.80e-06)	-5.89e-06(5.25e-06)	-2.67e-07(2.85e-06)
	Livestock holding in TLU (continuous)	0.06*(0.036)	-0.008(0.041)	-0.123**(0.048)	0.046(0.071)	-0.129*(0.077)
Social capital	Relative live abroad (1 yes; 0 otherwise)	0.268(0.284)	0.679**(0.282)	-0.597(0.391)	-5.042(95.13)	-0.650(0.606)
Market access	Residence distance from the nearby town in minutes (continuous)	0.002(0.003)	-0.004	-0.005(0.003)	0.0002(0.004)	0.008*(0.004)
	Residence distance from the all-weather road in minutes (continuous)	-0.003(0.003)	-0.004(0.004)	-0.002(0.004)	-0.002(0.005)	-0.003(0.005)
Support capabilities	Access to credit (1 accessed; 0 otherwise)	0.053(0.149)	-0.101(0.163)	0.109(0.173)	0.330(0.245)	0.365(0.268)
	Access to extension service (1 accessed; 0 otherwise)	0.125(0.231)	0.102(0.264)	-0.141(0.263)	0.122(0.322)	0.474(0.445)
Commercialization	Commercialization index (continuous)	0.896**(0.391)	0.848**(0.418)	-0.486(0.445)	-1.810**(0.828)	0.452(0.662)
Agro-ecology (lowland is base agro-ecology)	Highland agro-ecology (1 highland;0 otherwise)	0.632***(0.229)	0.602**(0.254)	0.033(0.258)	6.025(3,344)	0.837*(0.469)
	Midland agro-ecology (1 midland; 0 otherwise)	0.485**(0.222)	0.679***(0.244)	-0.212(0.268)	6.267(3,344)	1.126**(0.490)
District	Woreda (dummy, 1 Dembecha; 0 otherwise)	0.128(0.175)	0.370*(0.193)	-0.310(0.206)	0.465(0.291)	-0.497(0.333)
	Constant	-1.311***(0.487)	-2.231***(0.571)	0.900(0.555)	-4.548(3,344)	-3.421***(1.024)
	Observations	360	360	360	360	360

Likelihood ratio test of rho21(off-farm survival, on farm wealth accumulation) = rho31(non-farm survival self-employment, on-farm wealth accumulation) = rho41(non-farm survival wage-employment, on-farm wealth accumulation) = rho51(non-farm wealth accumulation, on-farm wealth accumulation) = rho32(non-farm survival self-employment, off-farm survival) = rho42(non-farm wage-employment, off-farm survival) = rho52(non-farm wealth accumulation, off-farm survival) = rho43(non-farm survival wage-employment, non-farm survival self-employment) = rho53(non-farm wealth accumulation, non-farm self-employment) = rho54(non-farm wealth accumulation, non-farm wage-employment) = 0: chi2(10) = 8.02196 Prob > chi2 = 0.6267.
Lowland is the base agro- ecology, standard errors in parentheses, *** significant at 1%, ** at 5%, * at 10%. Source, own survey

Conclusion and policy implications

The study aimed to improve understanding of rural households' criteria for identifying and characterizing livelihood activities, categorizing livelihood diversification strategies, and then analyzing determinants of rural households' choice of livelihood diversification strategies. Rural households' livelihood diversification strategies were classified and characterized by integrating purpose survival and wealth accumulation; sector: on-farm and non-farm; location: on-farm and off-farm; and function: wage-employment and self-employment. The integration of such criterion develops on-farm wealth-accumulation livelihood diversification strategy; non-farm wealth-accumulation livelihood diversification strategy; off-farm survival livelihood diversification strategy; non-farm survival self-employment livelihood diversification strategy; and non-farm survival wage-employment livelihood diversification strategy. The multivariate probit estimation revealed that male-headed households, commercialization, and agro-ecological factors significantly enhance rural households' engagement in wealth-accumulating strategies. Landholding size enhances participation in non-farm wealth-accumulation strategy, the estimated value of farm and non-farm equipment increases the probability of participation in non-farm wealth-accumulation strategy, livestock-holding size enhances participation in on-farm wealth-accumulation strategy, estimated value of crop production increases participation in non-farm wealth-accumulation strategy. The higher the estimated value of farm and non-farm equipment, the estimated value of crop produced, livestock holding size, and commercialization are associated with the lower the likelihood of participation in off-farm survival, non-farm survival wage-employment, and non-farm survival self-employment livelihood diversification strategies. This implies that, first, resource endowment increases rural households' participation in wealth-accumulation livelihood diversification strategies. Second, agro-ecologies are the interactions between agro-ecosystems and

socioeconomic circumstances that affect crop and livestock production consequently, affect choice of livelihood diversification strategies. Third, commercialization increased rural households' participation in wealth-accumulation livelihood strategies, implying that commercialization creates a backward and forward link between agricultural production and non-farm livelihood diversification strategies. These findings suggest that, in the absence of perfect credit markets, rural households' ability to engage in capital-intensive strategies improves with their wealth (Reardon et al., 2000).

The outcome demonstrates pathways for explaining rural households' livelihood diversification strategies. Household head sex, landholding size, estimated value of farm and non-farm equipment, livestock holding size, estimated value of crop production, agro-ecology, and commercialization are all determinants of livelihood diversification strategies. The findings ensure resource endowment and commercialization encourage rural households' participation in wealth-accumulation livelihood diversification strategies. On the other hand, resource-depleted agro-ecologies limit agricultural surplus production thereby household members engage in survival-oriented livelihood diversification strategies, might then induce participation in wealth-accumulation livelihood diversification strategies. Commercialization facilitates the backward and forward linkages between agricultural production and wealth-accumulation livelihood diversification strategies. By removing entry barriers, rural households are encouraged to participate in wealth-accumulation livelihood diversification strategies. Finally, the combination of agro-ecology based technological intervention and enhancing commercialization strengthening backward and forward linkages between agricultural intensification and wealth-accumulation livelihood diversification strategies, thereby improving the rural households' welfare. Future studies should broaden the understanding of rural households' livelihood diversification strategies. The classification of these strategies and their determinants may vary according to the socio-

economic status and resource endowment of households. Further research will enhance insights for policymaking and development interventions focused on improving rural welfare.

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