Journal of Infrastructure, Policy and Development 2024, 8(6), 6465.
https://doi.org/10.24294/jipd.v8i6.6465

Article

The contribution of livelihood diversification activities to poverty reduction of ethnic minority households: A case study in Son La Province, Vietnam

Ngoc Ninh Ho[1], Phuong Thao Lai[1,*], Thi Cam Anh Truong[2], Van Hung Hoang[3], Thi Thuy Do[3], Thuy Nguyen[4]

[1] Vietnam National University of Agriculture, Hanoi 12406, Vietnam
[2] NICOTEX Joint Stock Company, Hanoi 12406, Vietnam
[3] Hung Yen University of Technology and Education, Hung Yen 17817, Vietnam
[4] Chiba University of Commerce, Chiba 272-8512, Japan
*** Corresponding author:** Phuong Thao Lai, lpthao@vnua.edu.vn

CITATION

Ho NN, Lai PT, Truong TCA, et al. (2024). The contribution of livelihood diversification activities to poverty reduction of ethnic minority households: A case study in Son La Province, Vietnam. Journal of Infrastructure, Policy and Development. 8(6): 6465. https://doi.org/10.24294/jipd.v8i6.6465

ARTICLE INFO

Received: 15 May 2024
Accepted: 11 June 2024
Available online: 21 June 2024

Abstract: The livelihood of ethnic minority households in Vietnam is mainly in the fields of agriculture and forestry. The percentage of ethnic minorities who have jobs in industry, construction, and services is still limited. Moreover, due to harsh climate conditions, limited resources, poor market access, low education level, lack of investment capital for production, and inadequate policies, job opportunities in the off-farm and non-farm activities are very limited among ethnic minority areas. This paper assessed the contribution of livelihood diversification activities to poverty reduction of ethnic minority households in Son La Province of Vietnam. The analysis was based on the data using three stages sampling procedure of 240 ethnic minority households in Son La Province. The finding showed that the livelihood diversification activities had positively significant contribution to poverty reduction of ethnic minority households in Son La Province. In addition, the factors positively affecting the livelihood choices of ethnic minority households in Son La Province of Vietnam are education level, labor size, access to credit, membership of associations, support policies, vocational training, and district. Thus, improving ethnic minority householder's knowledge through formal educational and training, expanding availability of accessible infrastructure, and enhancing participation of social/political associations were recommended as possible policy interventions to diversify livelihood activities so as to mitigate the level of poverty in the study area.

Keywords: factors; livelihood diversification; poverty reduction; ethnic minority households; Vietnam

1. Introduction

Livelihood strategies refer to activities undertaken for the survival of households (Chuong et al., 2015; Shen et al., 2008). Over the past few decades, the close relationship between livelihoods and livelihood capital has been emphasized by the Department for International Development (DFID), as defined by DFID, these are the five core asset classes (or types of capital) for livelihood generation such as human, natural, financial, physical and social capital (DFID, 1999). People's ability to choose livelihood strategies is closely related to their capital and access to capital. Therefore, improving access to capital (e.g., education, social services) is key to effectively creating opportunities for the poor to improve their lives (Chambers, 1995). It also emphasizes the importance of studying the impact of capital on people's livelihood choices, therefore, understanding the factors influencing household livelihood choices is key to improving livelihoods (Huang et al., 2020).

In the current context, it is increasingly clear that agriculture is no longer the principal activity of rural households as a means of livelihood improvement and poverty alleviation, but a key factor now is becoming more important is the promotion and development of livelihoods diversification (Shambel and Rajan., 2017). Non/off-agricultural economic activities (including migrant workers, wage employment, handicraft production, wage employment in agriculture, provision of agricultural services, etc.) combined with agricultural activities will generate a stable income for households (Barret et al., 2001). Participation in both within-farm and off-farm activities plays an important role in increasing the income of rural households (Démurger and Yang, 2010). Participating in off-farm work helps diversify incomes and alleviate poverty (Tuyen, 2014; Oyinbo and Olaleye, 2016).

Currently, the livelihood approach is chosen and applied by many countries to reduce poverty sustainably, instead of the food-focused poverty reduction approach, the people-centered livelihood approach in the process of poverty reduction, selects suitable livelihood activities based on the household's livelihood capital (DFID, 2001). In Vietnam, livelihood diversification is an important policy for poverty reduction. Agriculture is the main livelihood of ethnic minority households in Vietnam, however, with the recent change in economic structure, the area of agricultural land is shrinking and the population is increasing. Therefore, the role of non-agricultural activities is increasingly focused on creating jobs and increasing incomes for the poor. Furthermore, the threat of external shocks forces many poor households to choose different livelihood activities to mitigate risks. Choosing a livelihood for poverty reduction is very important, it is necessary to orient properly and provide solutions to support surrogacy for households, especially ethnic minority households, this is the key to helping households out of poverty.

The Government of Vietnam has implemented a multidimensional measurement program on poverty nationwide since 2015. This was considered a notable remark in Vietnam's shift to a multidimensional poverty approach, including both income and non-income dimensions, from the former income-based one. This approach involves five indicators namely health-care, education, housing, water and sanitation, and information access (Duc, 2019). Within each dimension, there are two indicators of equal importance. A household is, therefore, categorized multidimensionally poor if it lacks at least three indicators (Duc, 2019). According to MOLISA (2024), Vietnam has a multidimensional poverty rate of only 5.71% in 2023. However, most of the poor are ethnic minority households, who live in the mountainous and marginalized regions of Vietnam.

The livelihood of ethnic minority households in mountainous regions like Son La Province in Vietnam mainly depends on agriculture and forestry. The percentage of ethnic minorities who have jobs in industry, construction, and services is still limited. Although it is the main source of livelihood, agricultural production has low efficiency, mainly for self-sufficiency and lack of commodity products, so the income level of ethnic households is lower than non- ethnic minority households (Ngan, 2014). The per capita income of ethnic minorities is currently about 1.1 million VND/person/month, the national average is 2.64 million VND/person/month, more than twice that of ethnic minorities (GSO, 2019). Thus, the per capita income of ethnic minorities is still very low compared to the per capita income of the whole

country. Besides, Vietnam is one of the countries greatly affected by climate change, under the impact, natural disasters occur more and more fiercely with greater frequency and intensity every day. Areas vulnerable to natural disasters and climate change are often the areas with high concentrations of poor populations in mountainous areas and ethnic minority areas (Oxfam, 2008). The impacts of climate change are one of the important causes of slow poverty reduction in ethnic minority areas.

Even though there have been several studies on livelihood of rural households and poverty in Vietnam in general and on poverty of ethnic minority households in particular (Alther et al., 2002; Baulch, 2010; Baulch et al., 2011; Baulch et al., 2012; Chuong et al., 2015; Duc, 2019; Dong et al., 2005; Do et al., 2020; Do et al., 2019; Giang et al., 2023; Hoang et al., 2014; Imai et al., 2011; Ninh et al., 2020; Ninh et al., 2022a, 2022b, 2002c; Pham et al., 2011; Tri and Thanh, 2023; Tuyen, 2014; Vu et al., 2019). However, the relationship between livelihood diversification strategies of ethnic minority household, and poverty reduction has not been studied, especially for using Simpson Diversification Index in combination with using econometric models to quantify the relationship. In addition, previous studies did not pay much attention on solving the endogeneity problem in estimating the relationship between livelihood diversification strategies and poverty reduction. Therefore, our study is thus aimed to fill this gap. We focus on finding the answers to the following research questions. First, what are the factors affecting the livelihood diversification of ethnic minority households? and second, how does the livelihood diversification strategies contribute to reducing the poverty of ethnic minority households? The answers to these questions would provide important insights on how to support the poor in Vietnam to overcome poverty and achieve sustainable livelihood strategies.

2. Literature review

Livelihood: According to the Department for International Development (DFID, 1999), livelihood could be defined as a bundle of resources and human abilities, incorporated with decisions and activities they make for their livings and realizing their targets and expectations. Ellis (2000) defined livelihood as assets (natural, physical, human, financial, and social assets), activities, and opportunities to access these assets and activities (through relationships material, and social relations) that jointly determine the life that individuals or households achieve. Five main types of assets include: natural capital that creates products for human existence (e.g., agricultural land, water); physical capital is assets created from economic production processes such as tools and equipment; human resources are the level of education and labor; financial capital is the ability to access credit; and social capital refers to social networks and associations where people can get support (Ellis, 2000).

Livelihood strategies as defined by DFID (1998) are the range and combination of activities and choices that individuals and communities carry out to attain their livelihood outcomes (including productive activities, investment strategies, reproductive choices, etc.). According to Scoones (1998), there are three main livelihood strategies for households: agricultural intensification, diversification of livelihoods, and migration. Based on different factors, especially the relationship

with external risks, Rennie and Singh (1996), and Soussan et al. (2001) separate livelihood strategies into two categories: adaptation (long-term change in behavioral patterns) and coping (short-term response to shock and stress). As such, there is no single livelihood strategy but a range of livelihood strategies. Hence, the key issue is how to choose the strategies that best suit the situation of the households.

Livelihood diversification: This comprises the range and combination of activities and choices that people undertake and make to achieve their livelihood outcomes and objectives for their standard of living, which is the ability of rural people to pursue one or a combination of strategies based on their access to assets (Chuong et al., 2015; Ellis, 2000; Minyiwab et al., 2024). Diversification is not only a survival for the poor but also an accumulation for the richer (Béné et al., 2003). Thanks to diversification, households can maintain their income stability in income, thereby ensuring the livelihood security at the same time as reducing vulnerability and poverty, leading to sustainable livelihood of households and economic development. Sources of income from different household livelihood activities could be classified into three groups as on-farm, off-farm, and non-farm activities. In simple terms, on-farm activities refer to all livelihood activities related to the agricultural production which occur on the farm; off-farm means activities that are related to agricultural production but occur outside of the field (e.g., processing, packaging, etc.); while non-farm activity is defined as a set of activities that do not constitute primary agricultural production (e.g., including value chain activities, such as agro-processing, transport, distribution, marketing, and retail, as well as tourism, manufacturing, construction and mining, plus self-employment activities (handicrafts, bakeries, mechanics, kiosks, and so on).

In term of measuring livelihood diversification: Based on the previous studies, there are different ways of estimating the level of household livelihood diversification. However, nowadays the indices of livelihood diversification calculated using Simpson Diversification Index (SID) was used by many studies (Chuong et al., 2015; John et al., 2020; Minyiwab et al., 2024; Tashikalma et al., 2015; Tyenjana and Taruvinga, 2019). Then, this study adopted the indices of livelihood diversification using Simpson Diversification Index in measuring livelihood diversification of ethnic minority households.

Factors affecting the livelihood diversification of household: Many previous studies have explored the factors affecting the choice of a household's livelihood strategies. For example, Peng et al. (2017) found that farming households have livelihood capital lowest, compared to migrant workers and non-agricultural households. The results showed that natural capital, household structure, labor quality, geographical location and ecological policies are the principal factors influencing the choice of livelihood strategy of farmers; Bekele and Rajan (2017) used a Multinomial Logistic Regression to analyze and show that age, family size and per capita income have influenced the choice of livelihood strategies of rural households in agriculture and non-farm activities at different significant levels; Cuong et al. (2019) focused on five types of livelihoods that local households are adopting and found that certain types of land were positively associated with choosing a highly profitable livelihood. In addition, the study showed that education plays an important role in income livelihood choices, which suggests that a better

education level will help households change from low-income to higher-income options; The study of Rahman & Akter (2014) also showed that households choose a variety of livelihood options. Their choices are significantly dependent upon various factors including socio-economic ones and resources (i.e., age, education, land size, and livestock resource) at the household level as well as the state of rural infrastructure. In general, resource-rich and educated households participate in diverse livelihoods, and rural infrastructure promotes that diversification; Do et al. (2019, 2020); Giang et al. (2023) and Ninh et al. (2022a, 2022b) showed that key factors influencing household livelihood option include household livelihood assets (human, social, natural, physical, and financial capital), vulnerability context (e.g., weather shocks, health shocks..), and local infrastructure (e.g., access to roads, irrigation systems, etc.). In summary, households' livelihood strategies diverse mainly due to the access to and control over five types of livelihood capital/assets (human, social, natural, physical, and financial capital). Moreover, the location factor including geographical location and distance to key facilities (such as road, market, electricity, irrigation system) also has influences on their choices of livelihood strategy.

The relationship between livelihood diversification and poverty reduction of household: Although poverty is a multi-dimensional issue, it is directly associated with a household's income, asset holding, and other economic activities that mutually generate a household's livelihood strategy and outcomes (Thorbecke, 2007). Several studies focused on the welfare outcome of a household's livelihood strategies have consistently found a positive relationship between livelihood diversification to the poverty reduction (Ansoms and McKay, 2010; Alemu, 2012; Barrett et al., 2001; Khatiwada et al., 2017; Oumer and de Neergaard, 2011; Oyinbo and Olaleye, 2016; Stifel, 2010). In addition, based on previous studies, there are number of factors affecting poverty status of household such as household livelihood assets (human, social, natural, physical, and financial capital), vulnerability context (e.g., weather shocks, health shocks), local infrastructure (e.g., access to roads, irrigation systems, etc.), and location dummies.

3. Conceptual framework

We used the Sustainable Livelihoods Framework (Ashley and Carney, 1999; Carney, 1998) as the conceptual framework to analyze the impact of the livelihood diversification strategy on household welfare such as poverty reduction and to examine the factors affecting the livelihood diversification as well as poverty status of ethnic minority households. Three elements make up the framework: livelihood assets, livelihood strategies, and livelihood outcomes (**Figure 1**). At the top of the figure, a rural household possesses five essential livelihood assets: human, social, natural, physical, and financial capital. The rural household selects its livelihood strategies based on these assets, the local infrastructure (e.g., physical accessibility), and the vulnerability context (e.g., weather shocks) it encounters. After choosing the appropriate livelihood strategies (including on-farm, off-farm, and non-farm activities), the rural household achieves a certain level of livelihood outcomes, such as increased income or reduced poverty.

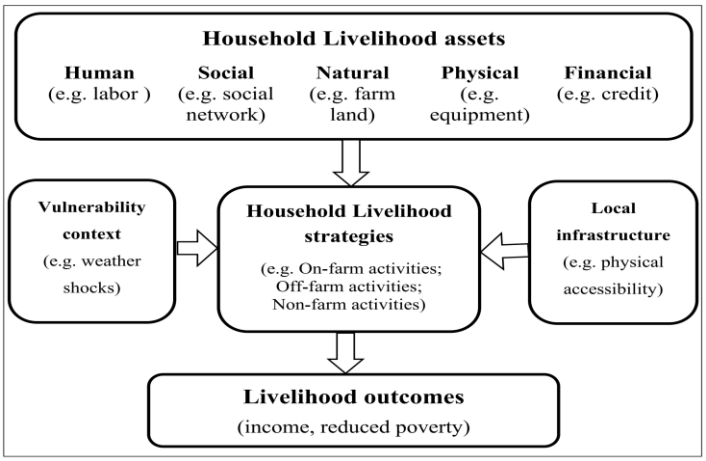

Figure 1. The conceptual framework for the study.

In this framework, the household livelihood strategies consist of on-farm activities (e.g., crop, livestock, aquaculture, and forestry production), off-farm (For example, off-farm activities involve income-generating work away from the farm, including wage or exchange labor on other farms and labor payments in kind, such as harvest sharing and other non-wage labor contracts). Non-farm activities consist of sectors like mining, manufacturing, utilities, construction, commerce, transport, and government services. As a result, these diversification strategies are theoretically impacted by household assets and living conditions, such as assistance from national or local governments.

4. Methodology

4.1. Description of the study area

Son La Province belongs to the Northern mountains of Vietnam, considered the poorest region of the country, are home to many ethnic minorities including H'Mong, Tay, Dao, Thai, Muong. Son La Province is a mountainous and highland province, located in the Northwest of Vietnam, with a natural area of about 14,125 km^2, accounting for 4.27% of the total area of Vietnam, ranking third among 63 cities and provinces. Son La Province's topography is mainly mountainous, accounting for over 85% of the province's natural area. In 2022, the province's population is 1,327,121 people, of which ethnic minorities account for 83.78%. Son La is a locality with a large number of ethnic minorities living. There are 12 ethnic groups in the province, of which the largest ethnic minority groups are Thai (accounting for 53.37%), Kinh (16.22%), H'mong (16.29%), Muong (6.94%), Xinh Mun (2.10%), the rest are other ethnic groups (People's Committee of Son La Province, 2022). The ethnic minority groups in Son La can also divided in two groups: (1) Ethnic minority group having population of less than 10,000 people in Vietnam such as La Ha ethnic group. This very less populated ethnic minority group is highly supported by the national and local government in order to protect and develop their livelihood activities as well as culture; (2) Ethnic minority group having population of more than 10,000 people in Vietnam, such as Thai, H'mong, Muong, Kho Mu, Xinh Mun, etc. Therefore, this study conducted survey with the two different ethnic minority

groups living in Son La Province (see more detail in Appendix **Table A1** and **Figure A1**).

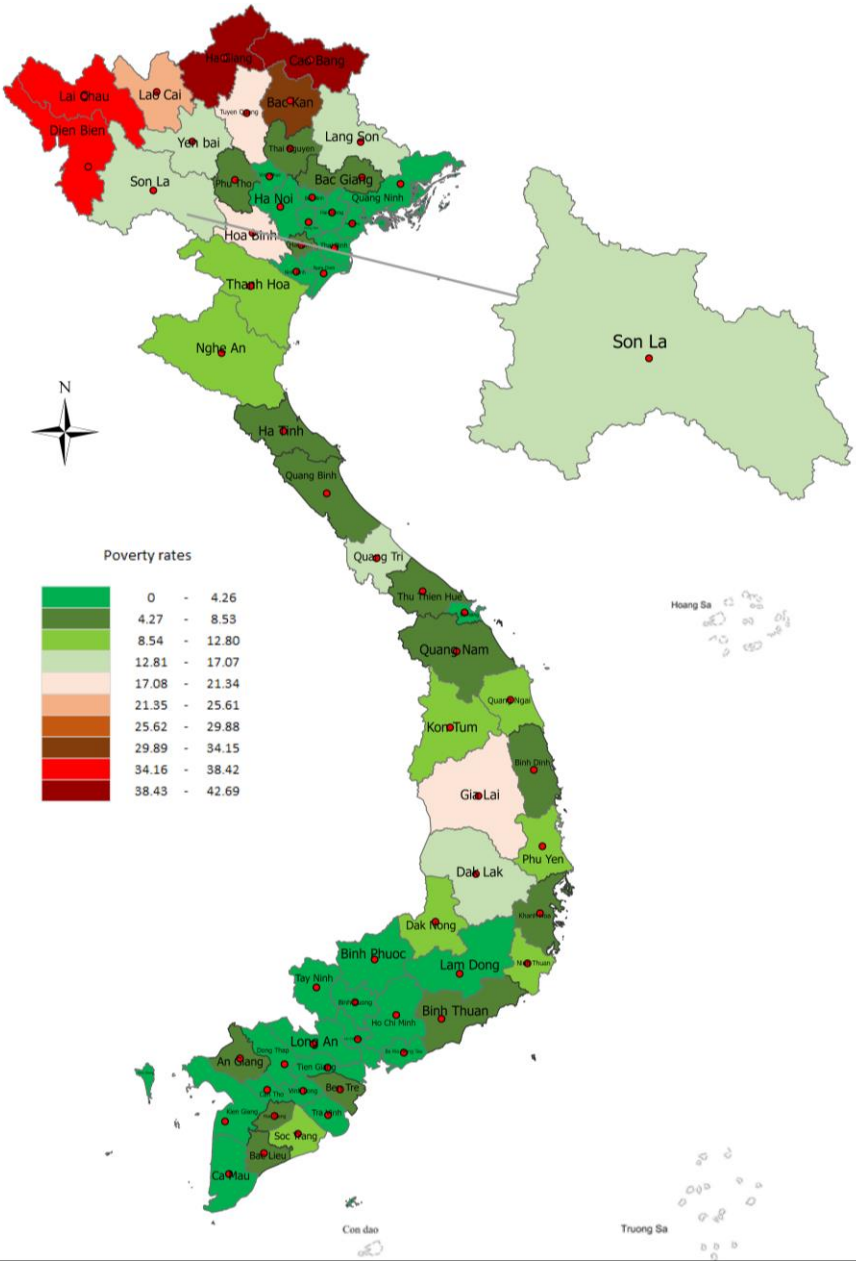

Figure 2. Vietnam's multidimensional poverty rate and the study site of Son La Province (Source: Developed by the research team based on the household multidimensional poverty rate in 2023).

Son La is one of the provinces having a sharp poverty reduction progress in the period of 2021–2023 in Vietnam. The multidimensional poverty rate of households in Son La Province in 2023 was only 14.17% (**Figure 2**), compared to the rate of 25.82% in 2018. With the support from governmental programs and policies, especially for the development of diversified livelihood activities of households and local communities partly contributed to poverty reduction in Son La Province. However, the percentage of the poor ethnic minority households over total poor households was 98.38%. It means that most of the poor in Son La Province are

ethnic people. Most ethnic minority households live in mountainous areas and their income is mainly based on agriculture production. However, due to harsh climate conditions, limited resources, poor market access, low education level, lack of investment capital for production, and inadequate policies, job opportunities in the off-farm and non-farm activities are very limited among ethnic minority areas in Son La Province.

4.2. Sampling and data collection techniques

This paper used primary data conducted in the two districts of Son La Province in 2021 using the designed questionnaires. A three-stage procedure for data collection was used for this study. The first stage was to select sampled districts. Based on district profiles and consultation with local experts, we selected two districts based on the following criteria: (i) representative in term of ethnic minority groups in the province, (ii) diversity of livelihood strategy choices of ethnic minority households, (iii) poverty incidence of ethnic minorities. The selected districts are Bac Yen and Quynh Nhai districts of Son La Province. In the second stage, two communes in each selected district were selected following the similar criteria as described above. During the last stage, 60 households in each selected commune were randomly chosen from a list of households provided by commune leaders. This allows us to set up a cross-sectional data set of 240 ethnic minority households in Son La Province (in which, Thai group accounted for 44.17% of total sample; H'mong group accounted for 32.08%; and La Ha is representative for the very less populated ethnic minority group, accounted for 23.75% of total sample).

Two questionnaires were used to gather data. The commune questionnaire captures commune-level data on population, infrastructure, and other socio-economic indicators of the commune. The household questionnaire documents livelihood information at the household level, including livelihood assets (human, physical, social, natural, and financial capital), livelihood activities (farming, non-farm self-employment, off-farm way employment, and other income generating activities) and livelihood outcomes. The subsidies/support they have received from various governmental programs for the ethnic minority households were also documented.

4.3. Data analysis

The analytical approach in this study was based on the combination of sustainable livelihood framework (SLA) and Ellis (2000), livelihood diversification indicators, categories of livelihood diversification strategies, and multidimensional poverty index of ethnic minority households in Son La Province.

Identifying the determinants of household livelihood diversification:

Based on the literature, the indices of livelihood diversification (LDI) calculated using Simpson Diversification Index (SID) was used in this study to estimate the nature and extent of livelihood diversification of ethnic minority households, which is the Simpson Diversification Index (SID) is defined as:

$$\text{SID} = 1 - \sum_{i=0}^{n} p_i^2 \quad (1)$$

where n is the number of income sources, p_i is the proportion of income from source I, and i is 1, 2, 3, …, n. In this study the indices of livelihood diversification (LDI) are presented as:

$$\text{LDI} = 1 - \{\left(\frac{i_1}{TI_i}\right)^2 + \left(\frac{i_2}{TI_i}\right)^2 + \left(\frac{i_3}{TI_i}\right)^2 \ldots + \left(\frac{i_n}{TI_i}\right)^2\} \quad (2)$$

where TI_i is total household income.

With this index, the LDI value always falls between zero and one. The LDI value is highest for households with the most diverse incomes and lowest for those with the least varied incomes, such as those relying on a single income source. For the least diversified households, the LDI value is zero. The upper limit for the LDI is one, determined by the number of accessible income sources and their proportional distributions (Chuong et al., 2015; Minyiwab et al., 2024). The Tobit model is applied to investigate the determinants of LDI (Chuong et al., 2015). In this study, LDI function is expressed as:

$$\text{LDI} = f(\text{household livelihood capital, shocks, community factors}) \quad (3)$$

In Equation (3), the explained LDI variable ranging from 0 to 1 is estimated by using Tobit model (Green, 2003). According to Chuong et al. (2015), this model assumes that the vector of explanatory variables X may explain a latent variable (unobservable) called y^*. When the latent above left censored observations (y_L) and below right censored observations (y_R) are present, the observable y_i is defined as being equal to the latent variable y^*.

$$y = \begin{cases} y^*, \text{if } y_L < y^* < y_R \\ y_L, \quad \text{if } y^* \le y_L \\ y_R, \quad \text{if } y^* \ge y_R \end{cases} \quad (4)$$

$$y^* = \beta X + \mu$$

$$\mu \sim N(0, \delta^2).$$

The vector of explanatory variables X in this study is described detail in Appendix **Table A2**. Tobit model is estimated using Stata software. Tests for collinearity and heteroscedasticity were conducted to eliminate the problems of econometric models (see Appendix **Tables A3** and **A4**).

Analyzing the effects of livelihood diversification on the multidimensional poverty status of ethnic minority of households:

A linear probability regression model (LPM) is used to determine the factors affecting the multidimensional poverty status of ethnic minority of households, including the livelihood diversification index (LDI). There is a mathematical formula as follows:

$$Y = \delta + \gamma \text{LDI} + \beta X_i + \varepsilon_i \quad (5)$$

Y is a dependent variable with two levels of values: $Y = 0$ if the household is not poor and $Y = 1$ if the household is poor. X_i represents the factors that influence the multidimensional poverty status of ethnic minority of households (X_i = independent variables). Livelihood diversification index (LDI) is concerned in this study. ε_i represents the corresponding parameters of the model to be estimated.

Equation (5)'s OLS estimation is probably going to have issues with reverse causality and missing variables. Unobserved consequences like a person's aptitude, entrepreneurial spirit, or propensity for taking risks could be the root cause of the

issue with missing variables. These effects, which are not quantifiable by the statistics, have the potential to simultaneously impact participation in livelihood activities and poor status (Hoang et al., 2014).

Reverse causality has two possible outcomes. On the one hand, poverty can have an impact on a person's likelihood of engaging in livelihood diversification, particularly if those activities call for a particular degree of endowment. However, impoverished households might be more motivated to abandon their farms in search of non-farm employment, which might provide better and more steady incomes. The endogeneity problem is a persistent issue that stems from both reverse causality and missing factors (Hoang et al., 2014; Nguyen et al., 2021). Therefore, this study adopted the instrumental variables estimation using heteroskedasticity-based instruments method that used by Hoang et al. (2014); Baum et al. (2012); Rigobon (2003); and Nguyen et al. (2021) to estimate Equation (5).

Factors affecting the livelihood diversification and multidimensional poverty status of ethnic minority households are included in the models as independent variables shown in Appendix **Table A2**.

5. Results and discussion

5.1. Characteristics of ethnic minority households

Table 1 shows that there is a higher percentage of the very less populated ethnic minority group for the poor households. Average age of the household heads is about 42.53 years old. Household heads of the non-poor households are younger compared to the poor households. In fact, households with an older age tend to choose only agricultural production, while younger household heads often diversify their livelihoods, combining agricultural activities with off/non-farm activities. The percentage of male-headed households is much higher than that of female-headed households, 78.33% of respondents are male and 21.67% are female.

In this study, the educational attainment in official schooling of ethnic minorities was 5.6 years, while number of years in official schooling of the poor households (3.81 years) is much lower compared to that of the non-poor households (8.38 years, almost completed secondary school). This can be explained that the non-poor household heads have higher income than the poor household heads, then they afforded to pay fees to achieve higher educational level. Therefore, it is a big challenge for the poor households to adopt some advanced technologies to diversify their livelihood activities due to low level of education (**Table 1**).

The results show that the average household size of ethnic minorities in Son La Province is 4.44 people (higher than the national average of 3.6 people/household). Most of the ethnic minority families here live for many generations, including parents and 1 to 3 children, living with grandparents. The average number of main employees is 2.69 persons/household, higher than the national average of 2.1 workers/household (GSO, 2022). In general, the household size of ethnic minorities in Son La is higher than the national average. This shows that ethnic minorities have abundant human resources they have the opportunity to diversify their income but they face huge challenges in terms of finding work and generating income.

Table 1. Basic characteristics of surveyed ethnic minority households.

Variable	Poor household	Non_poor household	Whole sample	Statistic test
	(*n* =146)	(*n* = 94)	(*n* = 240)	
LDI	0.16	0.46	0.28	−9.99***b
	(0.20)	(0.13)	(0.23)	
Ethnic	32.19	10.64	23.75	14.67***c
	(46.88)	(31.00)	(42.64)	
Age	44.77	39.05	42.53	4.27***b
	(9.72)	(7.99)	(9.49)	
Gender	72.60	87.23	78.33	7.21**c
	(44.75)	(33.55)	(41.28)	
edu	3.81	8.38	5.60	−9.70***b
	(2.96)	(2.62)	(3.60)	
Labor_size	2.51	2.96	2.69	−4.64***a
	(0.64)	(0.77)	(0.72)	
hh_size	4.38	4.53	4.44	−1.47a
	(0.71)	(0.80)	(0.75)	
Training	34.93	53.19	42.08	7.82**c
	(47.84)	(50.17)	(49.47)	
land_size	19,124.97	18,540.51	18,896.06	−1.34b
	(17,396.59)	(11,409.09)	(15,308.28)	
SPO	0.47	0.88	0.63	−4.53***a
	(0.58)	(0.75)	(0.68)	
Policy	72.60	76.60	74.17	0.48c
	(44.75)	(42.57)	(43.86)	
Mobile	1.58	2.15	1.80	−4.43***b
	(1.11)	(1.00)	(1.10)	
Loan	56.16	81.91	66.25	16.96***c
	(49.79)	(38.70)	(47.38)	
Motobike	0.91	1.15	1.00	−2.51**a
	(0.59)	(0.79)	(0.68)	
Weather_shock	1.73	1.97	1.82	−1.51a
	(1.30)	(1.16)	(1.25)	
Health_shock	1.84	1.86	1.85	0.30c
	(0.37)	(0.35)	(0.36)	
Irrigation	69.18	65.96	67.92	0.27c
	(46.33)	(47.64)	(46.78)	
Electricity	86.30	90.43	87.92	0.92c
	(34.50)	(29.58)	(32.66)	

Table 1. (*Continued*).

Variable	Poor household	Non_poor household	Whole sample	Statistic test
	(n =146)	(n = 94)	(n = 240)	
Distance	10.40	8.94	9.83	3.07**b
	(3.42)	(3.69)	(3.59)	
District	40.41	64.89	50.00	13.71***c
	(49.24)	(47.99)	(50.10)	
N	146	94	240	

*$p < 0.100$, **$p < 0.05$, ***$p < 0.01$; standard errors in parentheses; dummy variables were presented in percentage; a: *t*-test, b: nonparametric two-sample: Mann-Whitney *U* test, c: Chi^2 test.

Land is the most important natural asset for rural households. Ethnic minority households mainly grow rice and food crops on forest land and land for perennial crops due to the mountainous topography of Son La Province. According to survey data, on average, an ethnic minority household in Son La has about 18,896 m^2 of farm land. The largest area is agricultural land, accounting for more than 50% of the total land area of the household, the rest is forest land or water surface area. Although the land area of ethnic minority households is quite large, the land they own is of poor quality and not eligible for irrigation.

Table 1 also captures the differences in some other household assets and village characteristics between the poor and non-poor households. The results showed the non-poor households is characterized by: (1) higher numbers of motorbikes and phones; (2) higher numbers of associations/groups participated; (3) higher share of loan access, lower share of vocational training participated as compared to the poor households. Regarding village characteristics, the non-poor households reside closer to the district/commune's shops/markets where they can purchase agricultural and other inputs, higher access to electricity system, and poorer access to both irrigation and electricity compared to the poor households.

5.2. Livelihood strategies of households in the study area

The main sources of income for ethnic minority households are agricultural production, agricultural hired labor, handicrafts, wages, and migrant workers. The total income of ethnic minority households in the study area is about 33.5 million VND/year (**Table 2**).

Table 2. Livelihood strategies and income among household groups.

Livelihood activities	Whole sample			Non-poor households			Poor household		
	No.	%	Income (1000VND)	No.	%	Income (1000VND)	No.	%	Income (1000VND)
Agriculture	238	99.2	19,456.4	94	100.0	25,500.0	142	97.3	15,565.3
Off-Farm	125	52.1	10,802.9	83	88.3	23,603.2	42	28.8	2561.6
Non-Farm	41	17.1	3229.2	34	36.2	6861.7	7	4.8	890.4
Total	**240**	**100.0**	**33,488.5**	**94**	**100.0**	**55,964.9**	**146**	**100.0**	**19,017.4**

Regarding agriculture, cultivation is the main livelihood of ethnic minority households in Son La Province. However, the total income from crop production

only accounts for a small part of the total household income, because ethnic minority households the minority mainly grow rice, maize, cassava, and some households grow cardamom. Cultivation is still self-sufficient, there are not many products to increase income. In addition, the income of ethnic minority households also comes from livestock such as buffaloes, cows, pigs, poultry ... However, the income source of households with only agricultural production is lower than that of households associated with off or non-farm activities. Moreover, the per capita income of ethnic households is still very low, 0.632 million VND per person per month (lower than the poverty standard of 0.7 million VND per person per month).

Table 2 show that poor households had most income source from agricultural livelihood activities accounting for 81.85% of total income, while non-poor households are households with combined agricultural and off/non-agricultural livelihoods accounting for 72.34%. **Table 2** also shows that the rate of poor ethnic minority households is still high, accounting for 60.83% of the total surveyed households, of which the percentage of poor households who only work in agriculture accounts for 65.07%, which is much higher than that of households with agricultural and off/non-agricultural livelihood activities (34.97%). Thus, most of the households that only work in agriculture are poor, so an important key to poverty alleviation for ethnic minority households is to diversify their livelihoods. It is necessary to combine agricultural production with non/off-agricultural activities for diversifying livelihood activities of ethnic minority households in Son La Province.

According to the survey data, the livelihood of ethnic minority households in Son La Province depends mainly on agricultural production combined with a number of off- or non-agricultural activities (accounting for 57.5%). The percentage of households only engaged in agricultural production is still high at 42.5%, who are less diversified in livelihood activities leading to low level of household income as well as hard to escaping form the poor (**Figure 3**).

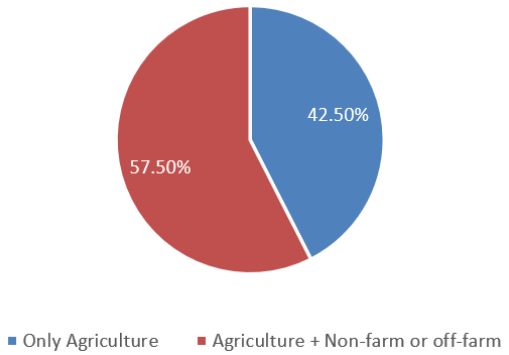

Figure 3. Livelihood strategies of ethnic minority households.

Off-farm activities are agricultural activities that take place outside the household's own farm. Activities include wage labor in the daily agricultural sector in the local or neighboring areas and are paid in cash. The main off-agricultural activities of ethnic minority households are sowing seeds, and harvesting... In addition, there are activities based on natural resources such as gathering from the forest (bamboo shoots, honey, reeds...) as another off-agricultural income source for some households in the study area.

Non-agricultural activities of ethnic minority households in Son La are activities that take place outside the agricultural sector. It includes handicraft activities (weaving, carpentry...) which are traditional occupations of ethnic minority households. In addition, some households are small traders such as fruit and vegetable traders and local drinks (corn wine, rice wine...) and tourism services. Non-agricultural activities are also migrant workers who come to big cities to look for jobs in enterprises.

5.3. Analysis of factors influencing the livelihood diversification of ethnic minority households

In the Tobit regression, based on the results of the test to check the appropriateness of the model, we have Prob > chi^2 = 0.00 (Sig. < 0.05), so dependent and independent variables in the model are statistically significant with confidence intervals above 95 and the selected model is in good agreement. The coefficient Pseudo R^2 = 0.720 which means that 72.0% of the change of the dependent variable is explained by 18 independent variables in the model, the rest is due to other factors (**Tabel 3**). There are no multicollinearity and heteroscedasticity problem in Tobit model based on the conducted tests (Appendix **Tables A3** and **A4**). From the results in **Table 3**, it can be seen that the factors affecting the livelihood diversification of ethnic minority households in Son La Province are as follows:

Ethnic group: This variable has a negative significance at 1% level to the livelihood diversification of ethnic minority households. It means the very less populated ethnic minority are less likely to diversify their livelihood strategies compared to others due to constraints of educational and social—cultural factors. They are scare of moving out of villages to get more opportunities for off-farm and non-farm in other provinces/cities, especially joining in the labor export market.

Educational level of household head: This variable has a significance at 1% level to positively the livelihood diversification of ethnic minority households. In other words, heads of households with a higher education year will make a decision to diversify their livelihoods rather than just doing a single livelihood activity (e.g., crop or livestock production in agriculture). This is because, highly educated people diversify their livelihood options through self-employment, salaried jobs, commerce, etc., while households with low levels of education are forced to engage themselves in low-priced labor, and have even fewer opportunities to work in non-farm activities than those with higher education. The ethnic minority households in Son La are mainly low-educated households, so the chance to diversify their livelihoods into the off or non-agricultural sector is very limited. The results are consistent with the findings of Cuong et al. (2019); Gebru et al. (2018); Do et al. (2020); and Peng et al. (2017), but in contrast to the findings of Eneyew and Beleke (2003) and Rahman et al. (2014).);

Labor size: Labor size has a positive and significant relationship to the livelihood diversification of ethnic minority households at 1%. This means that households with large labor size tend to engage more in off/non-farm activities. This means that the larger the labor size, the higher the probability of engaging in more livelihood activities such as off/non-farm activities, and the results are consistent

with the research conducted by Bekel et al. (2017); Cuong et al. (2019); Eneyew and Beleke (2003); Gebru et al. (2018); Minyiwab et al. (2024); and Rahman et al. (2014).

Table 3. Determinants of the livelihood diversification of ethnic minority households.

	Coef.	**Std. Err.**	***t***	***P > t***
Ethnic	−0.093**	0.047	−2.005	0.046
Age	0.000	0.002	0.101	0.920
Gender	0.016	0.039	0.411	0.682
edu	0.026***	0.005	4.875	0.000
labor_size	0.056*	0.029	1.905	0.058
hh_size	0.012	0.028	0.413	0.680
Training	0.093***	0.031	3.021	0.003
ln_land_size	−0.006	0.025	−0.241	0.809
SPO	0.070***	0.023	3.037	0.003
Policy	0.081**	0.036	2.233	0.027
Mobile	0.005	0.018	0.271	0.787
Loan_access	0.064*	0.036	1.782	0.076
Motobike	0.040	0.026	1.565	0.119
Weather_shock	−0.007	0.013	−0.574	0.567
Health_shock	−0.011	0.043	−0.264	0.792
Irrigation	−0.028	0.035	−0.808	0.420
Electricity	0.015	0.050	0.302	0.763
District	0.112***	0.041	2.741	0.007
_cons	−0.311	0.270	−1.153	0.250
Number of observations	240			
Log likelihood	−31.427			
LR $chi^2(19)$	161.71			
Prob > chi^2	0.000			
Pseudo R^2	0.720			

Note: *, **, *** significant at 10%, 5% and 1% respectively.

Participation in vocational training: This variable has a significance at 1% level and positively affects the livelihood diversification of ethnic minority households. This means that trained farmers will more likely diversify their livelihood activities. Thus, integrating agricultural training with non-farm training and connecting with businesses and cooperatives can increase the probability of participating in off-farm/non-farm activities for ethnic minority households. This result is similar to the study of Ninh et al. (2022a).

Participation in social, political associations/groups (SPO): This variable has a significance at 1% level and positively affected the livelihood diversification of ethnic minority households. It could be explained that the household heads who joined as a member of a social/political group may share information and learn knowledge from other members, leading to more likely to diversify their livelihood

activities. In fact, these social/political associations normally help members to cope with difficulties in finding good opportunities to access to resources (loan access, market information, labor demand). This finding plays an important role in supporting policy makers in forming associations, cooperatives in order to support the ethnic minority households in future. This result is similar to the study of Do et al. (2020); and Ninh et al. (2022a).

Access to governmental support policies: This variable has a positive and significant effect on the livelihood diversification of ethnic minority households at the 1% probability level, respectively. That is because the policy to support for ethnic minority households in Vietnam under national target programs mainly focuses on supporting the development of agricultural production as well as developing other livelihood activities in off-farm and non-farm activities for creating job and income. This result is similar to the study of Do et al. (2020); Ninh et al. (2022a), however in contrast to the results of Giang et al. (2023).

Loan access: This variable is statistically significant at 5% and has a positive impact on the ability to choose a diversified livelihood strategy that combines agriculture and off-farm or non-farm. This implies that the households with access to loans tend to diversify the livelihood activities. This positive impact is due to the current policy of loan support for ethnic minority households, which has diversified the purposes of borrowing capital, not only for agricultural development but also for households to have access to loan sources to develop non-agricultural activities. Therefore, the results of the study suggest that farmers' access to loans will play an important role in promoting the diversification of livelihood. These findings are also consistent with the results of Do et al. (2020); Gebru et al. (2018); Ninh et al. (2022b); Giang et al. (2023) and Minyiwab et al. (2024), however in contrast to the results of Eneyew and Bekele et al. (2003).

District dummy: The results show that ethnic minority households in Bac Yen district have more opportunities to diversify their livelihood activities compared to Quynh Nhai district. It can be explained that Bac Yen has many advantages to develop agricultural sector as well as service sector such as tourism (agricultural tourism, cultural tourism, and adventure tourism...). Then, the location dummy variable has a significance at 1% level to positively affect the livelihood diversification of ethnic minority households.

5.4. Effect of livelihood diversification on the multidimensional poverty status of ethnic minority households

Results of Linear probability regression model show that the livelihood diversification index (LDI) had negatively significant effect on the probability of being poor of ethnic minority households in Son La Province at 5%. It means that households with higher level of livelihood diversification are more likely to get out of the poor. It can be explained that livelihood diversification helps ethnic minority household to combat with shocks and diversify and improve their income sources. This finding is similar to the studies of Ninh et al. (2022b); Do et al. (2020); Hoang et al. (2014); and Nguyen et al. (2021).

In addition, the results in **Table 4** also showed that educational level of household heads, numbers of mobile phones have negatively significant effects, while support policy and numbers of dependent people in family have positively significant impact on the multidimensional poverty status. These findings are meaningful for policy makers to develop some interventions to support for ethnic minority households in mountainous and vulnerable areas to get out of the poverty.

Table 4. Effects of livelihood diversification on the multidimensional poverty status.

Variable	Coef.	Std. Err.	*t*	*P* > *t*
LDI	−0.814**	0.394	−2.067	0.040
edu	−0.056***	0.010	−5.507	0.000
Labor_size	−0.011	0.038	−0.291	0.772
Dependency	0.106***	0.040	2.619	0.009
Training	0.022	0.054	0.417	0.677
ln_land_size	0.026	0.035	0.749	0.455
SPO	−0.045	0.040	−1.140	0.255
Policy	0.113**	0.046	2.424	0.016
Mobile	−0.058**	0.026	−2.223	0.027
Loan_access	0.029	0.055	0.533	0.594
Motobike	0.050	0.039	1.274	0.204
Health_shock	−0.016	0.060	−0.275	0.784
Irrigation	−0.013	0.047	−0.272	0.786
Electricity	−0.055	0.062	−0.880	0.380
_cons	0.784**	0.363	2.162	0.032
Number of observations	240			
F(14, 225)	36.57			
Prob > chi2	0.00			
Centered R^2	0.5578			
Uncentered R^2	0.8268			
Under-identification	0.0032			
Over-identification	0.1051			
Weak-identification	3.586			

Notes: *, **, *** significant at 10%, 5% and 1% respectively.

6. Conclusions and policy implications

Currently, the livelihood of ethnic minorities in Son La Province still depends mainly on agriculture, however, many households know how to combine agricultural production and off/non-agricultural activities in order to sustain their livelihood activities. The key finding also show that the level of household livelihood diversification partly contributed to the multidimensional poverty status of ethnic minority households in the study area. Diversifying household livelihood strategies helped increase income of ethnic minority households and gradually get out of poverty status. Therefore, the government needs to pay attention to non/off-farm income-generating activities for rural communities and policymakers need to think

about the most appropriate ways to support the diversification of livelihoods for ethnic minority households which could later contribute to the poverty reduction and sustainable economy.

The analysis results demonstrated that the key factors affecting the livelihood choices of ethnic minority households in the Son La Province include: education level, number of employees, access to loans, governmental policy supports, membership in social/political organizations/groups, number of motorbikes, vocational training and location dummies.

Based on the research results, there are some policy implications as follows: Firstly, it is necessary to enhance human resources and improve education for ethnic minority households. It is necessary to pay more attention to fostering and improving the capacity of teachers, and to have special policies to support teachers in extremely difficult areas; further increase investment in facilities and equipment for teaching and learning in schools, creating the best learning conditions for young generation in the ethnic minority areas; secondly, it is necessary to diversify support policies related to all types of livelihood activities of ethnic minorities instead of focusing more on agricultural production. It is important to promote the development of non-agricultural occupations, provide vocational training for young people to transfer a part of ethnic minority workers to off-farm and non-farm livelihood activities; thirdly, vocational training needs to be more diversified, combining training in agricultural development and training in other non-agricultural occupations which will provide them more opportunities to have diversified income sources; fourthly, financial capital is a weakness of ethnic minority households, most ethnic minorities do not have enough capital for investing in agricultural production and other business. Therefore, it is needed to improve access ability to financial sources for ethnic minority by helping them to participate in social/political associations (e.g., establishing and strengthening cooperatives, common preference groups, and other groups).

This study relied on the cross-sectional data in examining the livelihood diversification and multidimensional poverty reduction of ethnic minority households in Son La Province, Vietnam. The nature of cross-sectional data limits the ability to distinguish the distinctive characteristics of households, such as attitudes, from other observable characteristics. The concept of livelihood diversification, status of poverty reduction, and vulnerability context is thought to vary over time. Therefore, future studies could try to use panel data to examine the dynamics of ethnic minority household livelihood diversification, and its contribution to poverty reduction in Vietnam.

Author contributions: Conceptualization, NNH; methodology, NNH, PTL and TCAT; software, NNH, TCAT and PTL; validation, NNH, TCAT, TTD, TN and PTL; formal analysis, NNH, VHH, TCAT, TTD, TN and PTL; investigation, NNH, VHH, TCAT, TTD, NT and PTL; resources, NNH and PTL; data curation, NNH, TTD, TCAT, TN and PTL; writing—original draft preparation, NNH, VHH, TCAT, TTD and PTL; writing—review and editing, NNH, VHH, TTD, TN and PTL; visualization, NNH, PTL and TCAT; supervision, NNH. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

References

Alemu, Z. G. (2012). Livelihood strategies in rural South Africa: Implications for poverty reduction. Selected paper prepared for presentation at the International Association of Agricultural Economists (IAAE). In: International Association of Agricultural Economists (IAAE): 2012 Conference; 18–24 August; Foz do Iguaçu, Brazil. pp. 2–24.

Alther, C., Castella, J. C., Novosad, P., et al. (2002). Impact of accessibility on the range of livelihood options available to farm households in mountainous areas of northern Viet Nam. Available online: https://www.researchgate.net/publication/235951899 (accessed on 13 March 2024).

Ansoms, A., & McKay, A. (2010). A quantitative analysis of poverty and livelihood profiles: The case of rural Rwanda. Food Policy, 35(6), 584–598. https://doi.org/10.1016/j.foodpol.2010.06.006.

Ashley, C., & Carney, D. (1999). Sustainable livelihoods: Lessons from early experience. London: Department for International Development.

Barrett, C., Bezuneh, M., & Aboud, A. (2001). Income diversification, poverty traps and policy shocks in Cote d'Ivoire and Kenya. Food Policy, 26(4), 367–384.

Baulch, B. (2010). Ethnic Minority Poverty in Vietnam. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1719672

Bekele, S., & Rajan, D. S. (2017). Rural Household Livelihood Strategies Choices: The Case of Humbo Woreda, Wolaita Zone, Southern Nation Nationalities and Peoples Regional State, Ethiopia. Journal of Economics and Sustainable, 8(3), 70–85.

Béné, C., Mindjimba, K., Belal, E., et al. (2003). Inland fisheries, tenure systems and livelihood diversification in Africa: The case of the Yae´re´ floodplains in Lake Chad Basin. African Studies, 62(2), 187–212. https://doi.org/10.1080/0002018032000148759

Baulch, B., Hoa, N. T. M., Phuong, N. T. T., et al. (2011). Ethnic minority poverty in Vietnam. In: Thang, N. (editor). Poverty vulnerability and social protection in Vietnam: Selected issues. Hanoi, Vietnam: Vietnam Academy of Social Sciences. pp. 101–165.

Baulch, B., Pham, H. T., & Reilly, B. (2012). Decomposing the Ethnic Gap in Rural Vietnam, 1993–2004. Oxford Development Studies, 40(1), 87–117. https://doi.org/10.1080/13600818.2011.646441

Baum, C. F., Lewbel, A., Schaffer, M. E., & Talavera, O. (2012). Instrumental variables estimation using heteroskedasticity-based instruments. Available online: http://fmwww.bc.edu/repec/bocode/u/UK12_baum.pdf (accessed on 15 December 2023).

Carney, D. (1998). Implementing the sustainable rural livelihoods approach. Pages 3–23 in Sustainable Rural Livelihoods: What Contribution Can We Make? D. Carney, ed. Department for International Development, London, UK.

Chambers, R. (1995). Poverty and livelihoods: Whose reality counts? Environment and Urbanization, 7(1), 173–204. https://doi.org/10.1177/095624789500700106

Chuong, O. N., Thao, N. T. P., & Ha, T. L. Y. (2015). Rural livelihood diversification in the South Central Coast of Vietnam. Available online: https://idl-bnc-idrc.dspacedirect.org/server/api/core/bitstreams/6c29ea79-87f8-4288-98d3-3b6221307013/content (accessed on 15 December 2023).

Cuong, H. V., Tuyen, T. Q., Yen, N. T. H., et al. (2019). Is Land Ownership a Key Factor in the Choice of Livelihood in the Mekong Delta, Vietnam? Springer Science + Business Media, LLC.

Démurger, S. M., & Yang, F. W. (2010). Rural households' decisions towards income diversification: Evidence from a township in northern China. China Economic Review, 21, S32–S44. https://doi.org/10.1016/j.chieco.2010.05.007

Do, T. L., Nguyen, T. T., & Grote, U. (2019). Livestock Production, Rural Poverty, and Perceived Shocks: Evidence from Panel Data for Vietnam. The Journal of Development Studies, 55(1), 99–119. https://doi.org/10.1080/00220388.2017.1408795

Do, T. L., Ninh, H. N., Thao, T. D., et al. (2020). Does cattle production contribute to improving welfare of poor ethnic minority households in Central Vietnam? Livestock Research for Rural Development, 32, 161.

Dong, H. S., Vinh, N. T., & Lan, C. N. (2005). Report on main challenges in growth and poverty reduction in the Northern mountain region of Vietnam. Development Strategy Institute, Ministry of Planning and Investment.

Duc, L. T. (2019). Multidimensional Poverty in Viet Nam: Sustainable Poverty Reduction 2016–2020. Multidimensional Poverty Peer Network, Dimensions, 8.

DFID. (1999). Sustainable Rural Livelihoods Guidance Sheet. DFID.

DFID. (2001). Sustainable livelihoods guidance sheets. DFID.

Ellis, F. (2000). Rural Livelihoods and Diversity in Developing Countries. Oxford University Press, Oxford.

Eneyew, A., & Bekele, W. (2003). Livelihood Strategies and its determinants in Southern Ethiopia: The case of Boloso Sore of wolaita zone. Agricultural Research and Reviews, 1(5), 153–161.

Gebru, G. W., Ichoku, H. E., & Phil-Eze, P. O. (2018). Determinants of livelihood diversification strategies in Eastern Tigray Region of Ethiopia. Agric & Food Secur., 7, 62. https://doi.org/10.1186/s40066-018-0214-0

General Statistics Office (GSO). (2019). Results of the survey on living standards of Vietnam's population in 2018. Statistical Publishing House, Hanoi.

General Statistics Office (GSO). (2022). Statistical Yearbook 2022. Statistical Publishing House, Hanoi.

General Statistics Office (GSO). (2023). Statistical Yearbook 2023. Statistical Publishing House, Hanoi.

Giang, T. H., Phuong, M. L., Ninh, H. N., et al. (2023). Factors affecting the livelihood diversity of ethnic minority migrants households in the Central Highlands of Vietnam (Vietnamese). Journal of Economics and Development, (314), 68–77.

Green, W. H. (2003). Econometric Analysis, 5th ed. Prentice Hall: Upper Saddle River, New Jersey.

Hoang, T. X., Pham, C. S., & Ulubaşoğlu, M. A. (2014). Non-Farm Activity, Household Expenditure, and Poverty Reduction in Rural Vietnam: 2002–2008. World Development, 64, 554–568. https://doi.org/10.1016/j.worlddev.2014.06.027

Huang, L., Yang, L., Tuyen, N. T., et al. (2020). Factors influencing the livelihood strategy choices of rural households in tourist destinations. Journal of sustainable tourism. Journal of Sustainable Tourism, 30(4), 875–896. https://doi.org/10.1080/09669582.2021.1903015

Imai, K. S., Gaihe, R., & Kang, W. (2011). Poverty, inequality and ethnic minorities in Vietnam. International Review of Applied Economics, 25 (3), 249–282. https://doi.org/10.1080/02692171.2010.483471

John, A. O., Carolyn Afolake, A., & Olubunmi Lawrence, B. (2020). Effect of livelihood diversification and technology adoption on food security status of rice farming households in Ogun state. Nigeria. Agricultural Social Economic Journal, 20(3), 233–244. https://doi.org/10.21776/ub.agrise.2020.020.3.7

Khatiwada, S. P., Deng, W., Paudel, B., et al. (2017). Household livelihood strategies and implication for poverty reduction in rural areas of central Nepal. Sustainability, 9(4), 612. https://doi.org/10.3390/su9040612

Minyiwab, A. D., Mengistu, Y. A., & Tefera, T. D. (2024) The effect of livelihood diversification on food security: evidence from Ethiopia. Cogent Economics & Finance, 12(1). https://doi.org/10.1080/23322039.2024.2345304

MOLISA. (2024). Results of multidimensional poverty rate of households in 2023. In: Decision No. 134/QĐ-BLĐTBXH issued. Ministry of Labour- Invalids and Social Affairs of Vietnam.

Ngan, N. T. (2014). Impact of climate change on the livelihoods of ethnic minorities in the northern mountainous region. Journal of Labor and Social Sciences, 39(Q2).

Ninh, H. N., Lam, D. T., Thao, T. D., et al. (2022a). Indigenous pig production and welfare of ultra-poor ethnic minority households in the Northern Mountains of Vietnam. Environment Development and Sustainability, 24(1), 156–179. https://doi.org/10.1007/s10668-021-01348-6

Ninh, H. N., & Anh, T. T. C. (2022b). Factors Influencing Poverty Status of Indigenous Ethnic Minority Households in Dak Nong Province, Vietnam (Vietnamese). Vietnam Journal of Agricultural Sciences, 20(6), 813–822.

Ninh, H. N., Tin, T. N., Thao, L. P., et al. (2022c). Current Situation and Solutions for Developing Shan Tuyet Tea Production in Bac Yen District, Son La Province (Vietnamese). Vietnam Journal of Agricultural Sciences, 20(11), 1528–1539.

Ninh, H. N., Tin, T. N., & Thao, T. D. (2020). Solutions to Sustainable Poverty Reduction for Ethnic Minority: A case study of La Ha Ethnic Minority Group in Quynh Nhai District, Son La Province (Vietnamese). Vietnam Journal of Agricultural Sciences, 18(12), 1211–1221.

Nguyen, T. T., Tran, V. T., Nguyen, T. T., et al. (2021). Farming efficiency, cropland rental market and income effect: evidence from panel data for rural Central Vietnam, European Review of Agricultural Economics, 48(1), 207–248. https://doi.org/10.1093/erae/jbaa013

Oumer, A. M., & de Neergaard, A. (2011). Understanding livelihood strategy-poverty links: Empirical evidence from central highlands of Ethiopia. Environ. Dev. Sustain., 13, 547–564.

Oxfam. (2008). Vietnam: Climate change, adaptation and the poor. Oxfam.

Oyinbo, O., & Olaleye, K. T. (2016). Farm Households Livelihood Diversification and Poverty Alleviation in Giwa Local Government Area of Kaduna State, Nigeria. The Journal of Sustainable Development, 15(1), 219–232.

Pham, H., Le, T., & Nguyen, C. (2011). Poverty of the ethnic minorities in Vietnam: Situation and challenges from the P135-II communes. State Committee for Ethnic Minority Affairs of Vietnam and United Naitons Development Program, Hanoi, Vietnam.

Peng, W., Zheng, H., & Robinson, B. E. (2017). Household Livelihood Strategy choice, impact factor, and environmental consequences in Miyun Reservoir Waterghed, China. Sustainability, 9(2), 175. https://doi.org/10.3390/su9020175

People's Committee of Son La Province (2023). Decision on approving the results of reviewing poor and near-poor households in 2023 in Son La Province, Vietnam. People's Committee of Son La Province.

People's Committee of Son La Province (2022). Decision on approving the results of reviewing poor and near-poor households in 2022 in Son La Province, Vietnam. People's Committee of Son La Province.

People's Committee of Son La Province (2021). Decision on approving the results of reviewing poor and near-poor households in 2021 in Son La Province, Vietnam. People's Committee of Son La Province.

Rahman, S., & Akter, S. (2014). Determinants of Livelihood Choices: An Empirical Analysis from Rural Bangladesh. Journal of South Asian Development, 9(3), 287–308. https://doi.org/10.1177/0973174114549101.

Rennie, J.K. & Singh, N.C. (1996). Participatory Research for Sustainable Livelihoods: A Guidebook for Field Projects. International Institute for Sustainable Development, Winnipeg, Manitoba, Canada.

Rigobon, R. (2003). Identification through heteroscedasticity. Review of Economics and Statistics, 85(4), 777–792. https://doi.org/10.1162/003465303772815727.

Scoones, I. (1998). Sustainable Rural Livelihoods: A framework for analysis. IDS, Brighton, UK.

Shen, F., Hughey, K. F. D., & Simmons, D. G. (2008). Connecting the Sustainable Livelihoods Approach and Tourism: A Review of the Literature. Journal of Hospitality and Tourism Management, 15(01), 19–31. https://doi.org/10.1375/jhtm.15.1.19

Stifel, D. (2010). The rural non-farm economy, livelihood strategies and household welfare. African Journal of Agricultural and Resource Economics, 4(1), 82–109.

Tashikalma, A. K., Michael, A., & Giroh, D. Y. (2015). Effect of livelihood diversification on food security status of rural farming households in Yola South local government area, Adamawa State, Nigeria. Adamawa State University Journal of Agricultural Science, 3(1), 33–39.

Thorbecke, E. (2007). Multidimensional poverty: Conceptual and measurement issues. In: The Many Dimensions of Poverty. Springer: New York, NY, USA. pp. 3–19.

Tuyen, T. Q. (2014). Determinants of nonfarm participation among ethnic minorities in the Northwest Mountains, Vietnam. Available online: http://mpra.ub.uni-muenchen.de/59158/ (accessed on 13 March 2024).

Tri, N. M., & Thanh, V. V. (2023). Strategies for poverty reduction to meet the requirements of sustainable development. Journal of Infrastructure, Policy and Development, 7(3), 2597. https://doi.org/10.24294/jipd.v7i3.2597

Tyenjana, A., & Taruvinga, A. (2019). Determinants of rural on-farm livelihoods diversification: The Case of Intsika Yethu local municipality, Eatern Cape, South Africa. Journal of Agribusiness and Rural Development, 54(4), 373–384. https://doi.org/10.17306/J.JARD.2019.01200

Vu, M. T., Vu, N. H., Hue, H. T., et al. (2019). Factors Affecting the Livelihood Outcomes of Households in the Mekong Delta of Vietnam. The International Journal of Humanities & Social Study, 7(4). https://doi.org/10.24940/theijhss/2019/v7/i4/HS1904-011

Appendix

Table A1. Basic socio-economic characteristics of Son La Province in period of 2021–2023 (GSO, 2023; People's Committee of Son La Province, 2021, 2022, 2023).

Indicators	Unit	2021	2022	2023
Total land area	(1000 ha)	1,411.0	1,411.0	1,410.9
Agricultural land area	(1000 ha)	1,053.0	1,060.6	1,061.2
Human population	(1000 persons)	1,311	1,327	1,342
Total number of households	(1000 households)	293.214	296.516	297.380
Number of ethnic minority households	(1000 households)	235.753	234.401	259.453
Total number of poor households	(1000 households)	63.509	52.883	42.147
Multi-dimensional poverty rate	%	21.66	17.83	14.17
Total number of poor ethnic minority households	(1000 households)	62.605	52.091	41.467
Percentage of the poor ethnic minority households*	%	98.58	98.5	98.39
GDP/Capita	Million VND/year	44.3	48.5	51.7

[a]Comparison of total number of the poor ethnic minority households over total poor households, GDP: Gross Domestic Products.

Table A2. Name and definition of the variables in the regression models.

Variable	Definition	Scale
Dependent variables		
Livelihood diversification Index (LDI)	Using Simpson Diversification Index (SID) to calculate the livelihood diversification Index following the study of Minyiwab et al. (2024)	Metric
Multidimensional poverty status (*Y*)	*Y* =1 if the ethnic minority household is poor, following the multidimensional poverty index of Vietnam applied in period of 2016–2020; *Y* = 0 if otherwise	Binomial
Independent variables		
Household livelihood capital		
Human capital		
Ethnic	Ethnic group of household head (1 = very less populated minority group; 0 = otherwise)	Binomial
Age	Age of household head (years)	Metric
Gender	Sex of household head (1 = male; 0 = female)	Binomial
Education	Number of years in school of household head	Metric
Labor_size	The number of family workers in household	Metric
hh_size	The number of family members in household	Metric
dependency	The number of family members in household are under 15 years old, or above 55 years old (female) and 60 years old (male)	Metric
Training	If the household participated in the vocational trainings (1 = yes; 0 = otherwise)	Binomial
Natural capital		
Ln_land_size	Logarithm of farm land area of household in square meter	Metric, m^2
Social capital		
SPO	Number of social/political groups/associations that household participated	Metric
Policy	If the household received the supports from the governmental production development policies (1 = yes; 0 = otherwise)	Binomial
Mobile	No. of mobile phones of household	Metric

Table A2. (*Continued*).

Variable	Definition	Scale
Financial capital		
Loan_access	If households with access to credit (including formal and informal sources of credit like banks, other credit organizations) (1 = yes; 0 = otherwise)	Binomial
Physical capital		
Motorbike	No. of motorbikes of household	Metric
Risk and shocks		
Weather_shock	Number of times affected by weather shocks during the last three years (times)	Metric
Health_shock	Number of times affected by Health shocks of household head during the last three years (times)	Metric
Village level		
Irrigation	If household has access to irrigation system (1 = yes; 0 = otherwise)	Binomial
Electricity	If households with access to electricity (1 = yes; 0 = otherwise)	Binomial
Distance	Distance from home to the nearest market/agricultural input shops	Metric, km
District level		
district	If household in Bac Yen district (1 = yes; 0 = otherwise)	Binomial

Table A3. Multicollinearity test for the Tobit model.

Variable	VIF	1/VIF
Ethnic	1.63	0.61
Gender	1.12	0.89
Age	1.44	0.69
edu	1.72	0.58
Labor_size	1.20	0.83
Weather_shock	1.15	0.87
Land_size	1.37	0.73
Irrigation	1.19	0.84
Distance	1.05	0.95
Motobike	1.43	0.70
Mobile	1.70	0.59
Loan_access	1.26	0.79
SPO	1.16	0.86
Electricity	1.19	0.84
Policy	1.11	0.90
Training	1.09	0.92
District	1.96	0.51
Mean	**1.34**	**-**

Notes: There is no multicollinearity problem in Tobit model.

Table A4. Homoscedasticity test for the Tobit model.

Test	Degrees of freedom	Chi^2	Prob. > Chi^2
White's test	161	161.78	0.4679
Breusch-Pagan test	17	22.13	0.1797

Notes: There is no heteroscedasticity problem in Tobit model based on the results of White's test and Breusch-Pagan test.

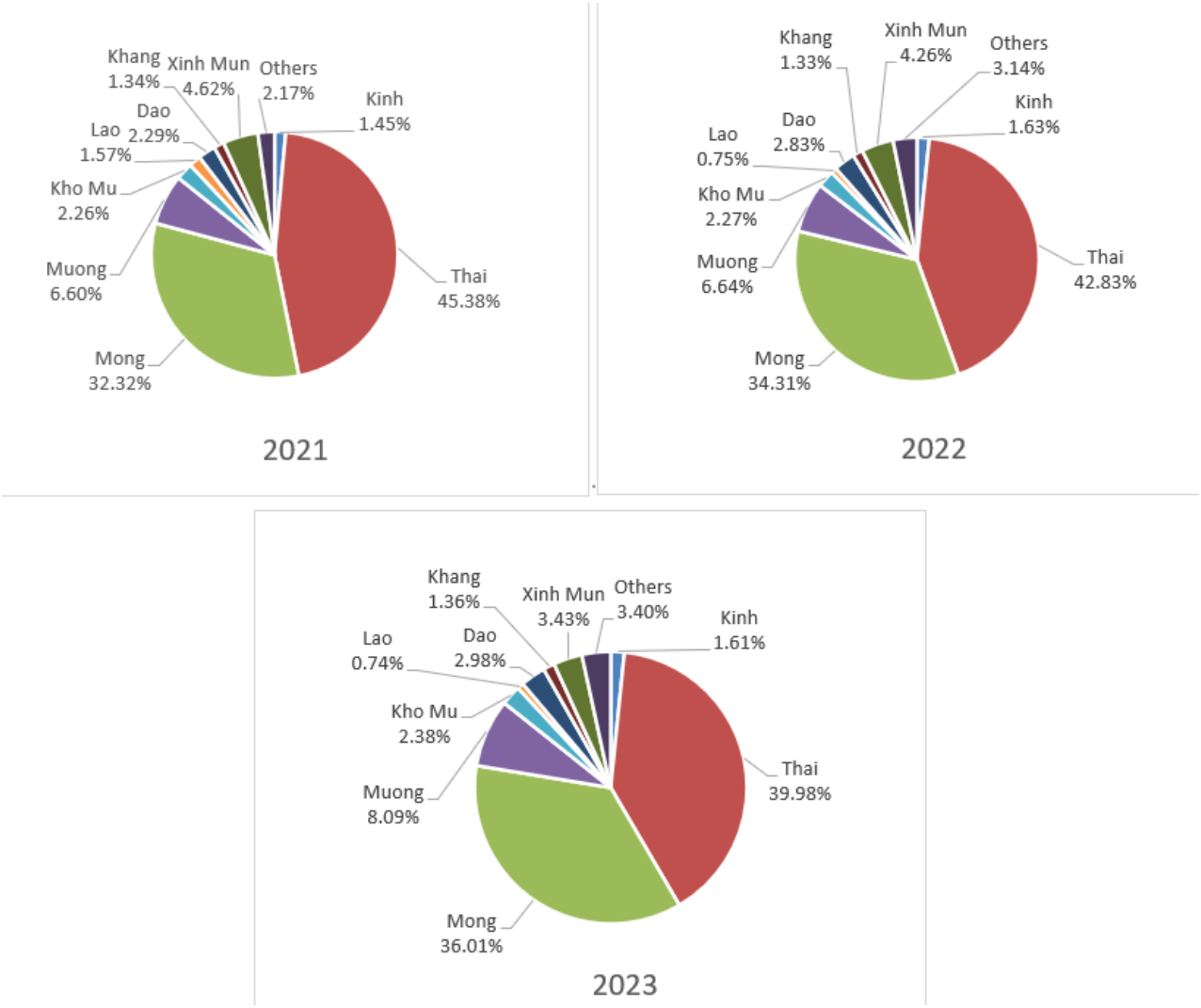

Figure A1. Percentage of the poor households by ethnic groups in Son Lan province in period of 2021–2023 (People's Committee of Son La Province, 2021, 2022, 2023).