Livelihood Choice and Household Economic Wellbeing in Vietnam's Northwest region

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Abstract

This paper examines factors affecting livelihood choices in the Northwest region, the country's poorest one, populated mainly by ethnic minorities. We utilized secondary data from the Vietnam Household Living Standard Surveys (VHLSS) in 2016 and 2018, and applied micro-econometric analysis. Our cluster analysis results offer the initial classification into six livelihood groups characteristic of rural households. Bonferroni pairwise tests are used to compare per capita income and poverty rates across livelihood options. We discovered that households with nonfarm or formal wage-earning livelihoods had the highest levels of income and the lowest poverty rates, while those reliant on the cultivation of crops had the lowest income and the highest poverty levels. A multinomial logit model is used to explore factors affecting livelihood choice. We found that ownership of more cropland reduces the likelihood of choosing high-return livelihoods. Furthermore, household head education has a beneficial effect on the pursuit of profitable occupations, meaning that improved education could lead to households shifting away from low-return activities. We also discovered that households in communes with available transportation are more likely to adopt high-return livelihoods.

Keywords: Cluster analysis; Household livelihoods; Northwest region; Multinomial logit; Income; Poverty

JEL: D 19; D60; D69

1. Introduction

ural livelihood diversification is the process whereby households develop a variety of livelihoods and social support skills in order to survive and improve their well-being (Ellis, 1998; Mottaleb & Ali, 2018). Rural livelihood diversification is important for lowering risk and enabling rural households to escape poverty, widespread in the rural areas of developing countries. Rural livelihood diversification and its importance for development have recently attracted the attention of an increasing number of researchers and policy makers in several developing economies (Tran & Vu, 2020; Do et al, 2019; Le, 2019; Mottaleb & Ali, 2018; Atamanov & Van den Berg, 2012; Rigg, 2006; Barrett et al, 2001; Ellis, 1998). In general, the literature confirms the significant contribution

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of rural nonfarm diversification to poverty reduction and income improvement and establishes that livelihood diversification out of agriculture has become a common trend in most developing societies (Tran & Vu, 2020; Mottaleb & Ali, 2018; Rigg, 2006).

Over the past decades, empirical evidence consistently indicates that livelihood choice is closely linked with household income and poverty status in rural Vietnam. For instance, in a study in 12 provinces over the 2008-2016 period (Tran & Vu, 2020), it was found that there was a switching from a crop-based livelihood to any other increased income and food consumption for rural households. Households living from nonfarm activities, wages or self-employment, were more likely to escape poverty in the Northwest (Tran et al, 2015), Central Highlands (Nguyen & Nguyen, 2019) and North Central regions (Nguyen & Tran, 2018). Similarly, households pursuing a formal wage-earning or nonfarm livelihood in the Mekong River Delta region earned the highest income (Hoang et al., 2019).

While a great deal of research has concentrated on all rural areas or some specific geographical regions of Vietnam, to the best of our knowledge there is limited evidence on factors affecting livelihood choice among households in the Northwest region. Inhabited mainly by ethnic minorities (General Statistical Office of Vietnam [GSO], 2018; World Bank [WB], 2013), this region is the poorest compared with the overall population. When designing or executing policy measures to promote their economic welfare, a deeper knowledge of the determinants influencing livelihood choice in this poorest region is critical. A consideration of the importance of the research topic and the dearth of literature on the subject prompted us to conduct the current study and answer three questions: (i) What types of livelihoods are pursued by local households? (ii) Which livelihood yields better returns? and (iii) What factors are associated with livelihood choice in the study region?

Our study contributes to the literature in several ways. Firstly, previous studies on the Northwest region focused only on certain specific nonfarm activities, such as wageearning occupations or self-employment (Tran et al., 2016), migration vs non-migration (Ngoc & Yokoyama, 2019), agriculture vs non-agriculture (Huong, Yao, & Fahad, 2019; Nguyen & Leisz, 2021). More importantly, few studies have classified household livelihoods using the term "livelihood choice," employing cluster analysis techniques. Our study applied cluster analysis techniques to identify various livelihoods adopted by local households in the Northwest region. Secondly, in contrast with previous studies that often ignore heterogeneity in the agricultural sector, we disaggregate it into various subsectors, namely cultivation, husbandry and forestry. Thirdly, we divide wage-earning activities into two sub-categories, including formal and informal wage-paying work (work with and without a social insurance book). In so doing, we identify various income sources for classifying diverse livelihoods, allowing for better identification of the choice of household livelihoods in the Northwest region.

Using a cluster analysis technique, we provide a detailed, quantitative classification of six livelihood groups adopted by local households. In addition, we find that households with a formal wage-earning livelihood achieved the highest income level and lowest poverty rate, while those following a crop-based livelihood earned the lowest income and had the highest poverty level. Notably, our econometric analysis shows that

the choice of profitable livelihood is positively linked with better education and negatively associated with cropland. Also, access to public transportation increases the chance of households pursuing high-return livelihoods. Such findings are useful for suggesting policy implications that enable local households to improve their economic wellbeing.

The rest of the paper is structured as follows: the literature review is given in Section 2, followed by data and analytical methods in Section 3. Results are provided in Section 4 while the discussion is included in Section 5. Section 6 concludes with some policy implications.

2. Literature review

The term "household livelihood" refers to a way of living that allows a household to survive and meet its fundamental needs (Khatun & Roy, 2012). A diversified livelihood is one where family members have a variety of occupations and communal skills to sustain and enhance their well-being (Ellis, 1998). This study uses liyama's (2006) definition of livelihood choice, a combination of agricultural, non-agricultural and other activities to earn a living. This definition is employed here because it specifically identifies the different types of activities that households can engage in. Households with diverse livelihoods are more likely to be better able to cope with shocks, utilize natural resources sustainably, and provide possibilities for future generations (Schwarze & Zeller, 2005).

Empirical evidence suggests that given their abilities and access to assets, households can pursue one or a mix of activities to maximize their well-being. Within this framework, restrictions on a given livelihood choice would be determined by a large number of exogenous variables, including both contextual and householdrelated factors, which may be informed by the livelihood framework (Hoang et al, 2020; Rahman & Akter, 2014; Tran et al, 2014). In several developing countries, the literature generally shows that rural households with better education and skills are more likely to adopt nonfarm livelihoods, either wage-earning or selfemployment, which yield much higher earnings than agricultural livelihoods (Tran & Vu, 2021; Tran, 2014; Haggblade, Hazell, & Reardon, 2010; liyama, 2006; Rigg, 2006). For instance, in Vietnam (Hoang et al., 2019), Bhutan (Mottaleb & Ali, 2018) and Bangladesh (Rahman & Akter, 2014), households whose head attains any level of general education is more likely on average to choose a nonfarm livelihood than those without formal education. Also, some studies find that social capital plays a crucial role in the pursuit of profitable nonfarm activities. Households with a membership in certain groups or organizations are more likely to engage in nonfarm activities (Siegel, 2005; Davis, 2003).

A review by Tran (2014) reveals that while land has emerged as a major determinant of livelihood choice in several developing societies, it is not an equally important factor determining rural livelihoods in all agrarian countries. Land is vital for rural livelihoods in rural India (Fernandes, 2011; Mahapatra, 2007), Rwanda (Ohlsson, 2000) and South Africa (Shackleton et al, 2007), where there have been limited opportunities for farmers to diversify toward nonfarm activities. In such countries, since farming is the only viable option for farmers, lack of land poses

a serious challenge to rural livelihoods. However, land is becoming less essential in shaping rural livelihoods in other countries, such as China (Chen, 1998; Parish, Zhe, & Li, 1995) and Bangladesh (Toufique & Turton, 2002), most likely because people there have a greater opportunity to participate in nonfarm economic activity.

As noted by Atamanov and Van den Berg (2012), larger land holdings may reduce the incentive to participate in nonfarm livelihoods but boost the capacity to engage in or expand high-return nonfarm activities by investing revenue from agricultural activities. However, empirical evidence consistently confirms that in several countries, households with little or no land tend to specialize in nonfarm activities, which in turn enable households to improve their well-being and reduce their vulnerability. For instance, households with limited land tend to engage intensively in the rural nonfarm economy, which in turn enables them to obtain higher income and reduce their impoverished status in the Mekong Delta region of Vietnam (Hoang et al, 2019), the Kyrgyz Republic (Atamanov & Van den Berg, 2012), Bangladesh (Toufique & Turton, 2002), Cote d'Ivoire and Kenya (Barrett et al, 2001), and some areas of rural China (Parish et al., 1995).

The literature indicates also that households with more assets are more likely to take up nonfarm livelihoods (wage-earning or self-employment activities) (Mottaleb & Ali, 2018; Rahman & Akter, 2014). Some studies indicate that households headed by women are less likely to pursue nonfarm livelihoods (Rahman & Akter, 2014; Rigg, 2006). In several studies, not only household characteristics but also contextual factors have a significant effect on livelihood choice. For instance, better access to rural infrastructure (roads, irrigation and electricity) increased the likelihood of rural households diversifying their livelihoods towards nonfarm activities in Bangladesh (Rahman & Akter, 2014) and some other developing economies (Reardon et al, 2000). Similar evidence is also reported for rural Vietnam, where households with access to roads or trade villages or near urban areas are more likely to adopt profitable nonfarm livelihoods (Hoang et al., 2019; Tran et al, 2016; Tran, 2015; Tran et al., 2014).

In Vietnam. usina cluster analysis techniques, recent studies have investigated factors associated with livelihood choice in certain specific regions. For instance, Hoang et al. (2019) examined the effect of land shortage in the Mekong Delta region, the North Central Coast (Hoang et al., 2020), and Hanoi peri-urban areas (Tran et al., 2014). To the best of our knowledge, however, no similar study has been done in the Northwest region, Vietnam's poorest one, where most of the population consists of ethnic minorities. It is crucial for both researchers and policy makers to gain a better understanding of the factors affecting livelihood choices and which result in higher economic well-being in the region.

3. Data and methods

3.1. Data

Secondary data from the VHLSS in 2016 and 2018 are used in our research. The General Statistical Office of Vietnam [GSO] conducted the survey, with a sample size of 46995 households in 3133 communes/wards. National, regional, urban, rural, and provincial levels were all represented in the survey, which covered 63 provinces. Face-to-face interviews with household heads, household members, and senior commune officials were conducted

over four periods to gather the data. The survey includes detailed information on socioeconomic characteristics of households and communes, such as demography, education, economic activity and revenue sources, land and durable assets, job prospects, and public infrastructure access, among other Livelihood Choice and Household Economic Wellbeing in Vietnam's Northwest region

things. Our research includes data from both households and communes in the Northwest region (Figure 1). After eliminating cases with missing values for any of the relevant variables, our effective sample includes 5076 households with 2522 households in 2016, and 2554 households in 2018.



Figure 1. Map of the Northwest region, Vietnam Source: Tran (2015)

3.2 Methods

A flowchart of the whole methodology used in the current study is displayed in Figure 2. The method for classifying livelihood groups is given in Section 3.2.1, followed in Section 3.2.2 by a discussion of the method for comparing income and poverty across livelihood groups. Section 3.2.3 describes econometric models for quantifying factors affecting livelihood choice.





3.2.1. Identification of household livelihoods

We employ cluster analysis tools to determine which livelihood strategies rural households are currently pursuing. This method allows researchers to assign a large number of households to an exhaustive set of mutually exclusive groups, with households similar to one another in one group or cluster and those that differ in another group (Everitt et al, 2011). This technique is widely used in a variety of sectors, including medicine, psychology, marketing, and economics (Everitt et al, 2011; Romesburg, 2004). We employ the various proportions of income sources as input variables for cluster analysis, following the guidelines in Ellis (2000) and other empirical studies on rural Vietnam (Tran et al., 2014; Hoang et al., 2020). Because the selected household sample includes rural households, seven income sources are used: (1) informal wage income (income from wagepaying work without a formal labour contract); (2) formal wage income (income from wagepaying work with a formal labour contract); (3) nonfarm income (income from nonfarm self-employment activities at the individual or household level); (4) cultivation income; (5) husbandry income; (6) forestry income; and (7) non-labour income (income from remittances, transfers, rentals and interest, etc.).

Following the method suggested in previous research (Everitt et al., 2011; Punj & Stewart, 1983), our study employs a twostage cluster analysis method. To begin with, the average linkage technique is utilized to identify preliminary clusters. For the cluster analysis stopping criterion, we apply the Calinski-Harabasz pseudo-F, frequently used to find the ideal number of clusters based on the pairwise distance matrix (Halpin, 2016). According to the findings, the greatest value of pseudo-F was 3042.31, corresponding to

six clusters (see Appendix 1). Second, the K-mean cluster is utilized to divide households into mutually incompatible livelihoods. Finally, we label, describe, and interpret the clusters by comparing income structure across livelihoods.

3.2.2. Comparing economic well-being across livelihoods

Guided by several studies (Deaton, 1997; DFID, 1999; Wolff, Zacharias, & Caner, 2005), we measure household economic well-being by household income and poverty status (1 if a household rates as poor and zero otherwise). Following previous studies (Cheruiyot, 2020; Hoang et al., 2019; Verkaart et al, 2018), we also compare income per capita among livelihood categories using the Bonferroni method for pairwise multiple comparisons of means. We must compare all pairs of occupations to discover if any are noticeably different. According to McNeese (2009), the number of pairwise comparisons (k) is calculated as (G)(G-1)/2, where G is the number of livelihood groups. There is a total of 6(6-1)/2 = 15 pairwise differences to analyze in our study because there are six livelihood groups. We also look at the relationship between the poverty status of households and the livelihood strategy they choose, using Dunn's multiple-comparison test for stochastic dominance with a Bonferroni adjustment.

3.2.3. Econometric models

Factors affecting a household's choice of income generation were investigated using a multinomial logit model (MNLM) because the choice of livelihood strategy is a polychotomous variable. Let (j=1, 2, 3, 4, 5, 6) signify the likelihood of a household selecting a particular livelihood strategy (Cheng & Long, 2007). Livelihood with j=1 indicates a formal wage-earning livelihood, j=2 an informal wageLivelihood Choice and Household Economic Wellbeing in Vietnam's Northwest region

earning livelihood, j=3 a cultivation livelihood, j=4 a non-labour/cultivation livelihood, j=5 a diversified agriculture livelihood (cultivation/ husbandry/forestry), and j=6 a nonfarm livelihood. According to Cheng and Long (2007), we then obtain the multinomial logit model by:

$$P_{ij}(j=k|X_i) = \frac{\exp(\beta_k X_i)}{\sum_{j=1}^{5} \exp(\beta_j X_i)} (j=1,2,3,4,5,6)$$
(1)

To identify the model, one of the livelihoods should be set to zero, and coefficients should then be interpreted in relation to that category, known as the reference or base category (Train, 2003). When one livelihood group (for example, the cultivation group) is set to zero, the MLM for each group can be recast as follows (Cheng & Long, 2007):

$$P_{ij}(j = k|X_i) = \frac{\exp(\beta_k X_i)}{1 + \sum_{j=1}^5 \exp(\beta_j X_i)} (j = 1, 2, 4, 5, 6)$$

and $P_{ij}(j = 1|X_i) = \frac{1}{1 + \sum_{j=1}^6 \exp(\beta_j X_i)}$ (2)

Equation (3) was used to estimate factors associated with livelihood choice, where β_i is the parameter that needs to be estimated, X_{ij} is a vector of household characteristics, C_i is the commune-related variable, and u_i is an error term. All estimates account for sampling weights and are clustered at the commune level.

$$LC_i = \beta_{0+} B_1 X_i + \beta_2 C_i + u_i$$
 (3)

Our model accounts for a variety of personal and household factors, based on DFID's (1998) sustainable rural livelihood framework and earlier empirical investigations, as already discussed in the literature. These include the age, gender, ethnicity, marital status and education of the household head, various types of land, and social capital. The first column in Table 5 provides a description and definition of the explanatory variables

included. In the regression analysis, some commune variables are included to controlled for fixed-commune effects (Tran, 2016).

4. Empirical results

4.1. Descriptive statistics analysis of household characteristics

In order to identify various livelihood strategies chosen by local households, we label, describe, and interpret the clusters by comparing income structure across livelihoods, using the data in both years as given in Table 1. As shown in the first column of Table 1, six livelihood groups are identified via cluster analysis techniques. In addition, proportion of mean income by source is also given for the full sample as well as for each group. For the whole sample, on average, cultivation accounts for the largest contribution to total income (30%), followed by informal wage-paying work (24%), husbandry (12%) and nonfarm activities (11%). However, such an income structure varies greatly across livelihoods. On average, the cultivation of various crops accounts for approximately 65% of the total income for those dependent on a farming livelihood. The mean share of formal and informal wage income makes up around 73% and 63%, respectively, for those pursuing a formal or informal wage-earning livelihood. Nonfarm income contributes about 72% of total income for those taking up a nonfarm livelihood. The total income is derived from crops (29%), husbandry (26%), and forestry (21%), respectively, for those following a diversified agricultural livelihood. Finally, those dependent on a non-labour income/cultivation livelihood earn, on average, about 55% and 19%, respectively, of their total income from non-labour sources and crops.

		(1)	(2)	(3)	(4)	(5)	(6)
Proportion of mean income by source	Full sample	Formal wage	Cultivation	Informal wage	Non-labour/ cultivation	Agricultural diversification	Nonfarm self- employment
Formal wage income	0.05	0.73	0.00	0.01	0.01	0.01	0.03
Informal wage income	0.24	0.06	0.05	0.63	0.07	0.10	0.05
Cultivation	0.30	0.07	0.65	0.17	0.19	0.29	0.08
Husbandry	0.12	0.05	0.12	0.07	0.08	0.26	0.06
Forestry	0.09	0.02	0.09	0.05	0.08	0.21	0.02
Nonfarm	0.07	0.03	0.01	0.02	0.02	0.04	0.72
Non-labour (other incomes)	0.11	0.05	0.08	0.06	0.55	0.09	0.04
Observation	5076	325	1273	1579	473	1069	357

Table 1. Livelihoods and their	corresponding	income sources
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Source: Authors' estimation using data from the 2016-2018 VHLSS.

Table 1 shows that the formal wageearning livelihood group contains about 325 households, corresponding to about 6% of the total household sample (Figure 3). The proportion of households with this livelihood strategy remained unchanged between 2016 and 2018. Those living from land cultivation make up 1273 households, accounting for 25% of the total sample. The percentage in this group declined slightly from 26% to 24% over the two years. Those living from informal wages made up 1579 households and the percentage for this group increased from 29% to 33% over the same period. The number

of households with non-labour/cultivation incomes rose from 9% in 2016 to 10% in 2018. Also, the percentage of households in the diversified agriculture livelihood group increased from 21% to 22% between 2016 Livelihood Choice and Household Economic Wellbeing in Vietnam's Northwest region

and 2018. Finally, the data show that 357 households were in the nonfarm livelihood group, with their corresponding percentages at 7% and 8% in 2016 and 2018.



Source: Authors' estimation using data from the 2016-2018 VHLSS. Figure 3. Livelihood groups by year

Table 2 reports the level of economic well-being across livelihood groups in both years. For the whole sample, overall, monthly income per capita totaled about 1.381 and 1.714 million Vietnamese dong (VND) in 2016 and 2018, respectively. In both years, the data show that the highest income level is found for those with a formal wage or nonfarm livelihood, while the lowest is seen among those with a cultivation livelihood. For example, per capita monthly income is about 938,000 VND (in 2016) and 962,000 VND (in 2018) for those taking up a cultivation livelihood. The corresponding figures are 3.046 million VND and 3.597 million VND for those choosing a formal wage livelihood. Also, the lowest poverty rate is found for those in the formal wage-earning livelihood group, while the highest level is found for those in the cultivation livelihood group (59.55 % and 45.72 % in 2016 and 2018, respectively).

analysis results in Table 3 confirm that those pursuing a cultivation livelihood have the lowest income and the highest poverty rate. By contrast, those in the formal wage and nonfarm livelihood groups have the highest income levels and the lowest poverty rate. According to the findings in Tables 3 and 4, those in the informal wage livelihood group have a higher income and a lower poverty level than those specializing in cultivation or diversifying into agriculture. In 2016, and 2018, the per capita income of those with an informal wage livelihood was 372 and 660 thousand VN higher than that of those with a cultivation livelihood. The findings indicate that, on average, households pursuing a cropbased or diversified agricultural livelihood attain lower well-being than those adopting an informal or a formal wage-earning livelihood.

In particular, the statistical inferential

Year	201	2016 2018			
Livelihood	Income/person/ month	Poverty rate	Income/person/ month	Poverty rate	
Formal wage	3046	0.66%	3597	0.00%	
	(1576)		(1854)		
Cultivation	938	59.55%	962	45.72%	
	(1262)		(773)		
Informal wage	1309	26.13%	1622	11.91%	
	(825)		(1057)		
Nonlabour/cultivation	1240	42.21%	1968	15.72%	
	(1483)		(2121)		
Diversified agriculture	1151	43.72%	1291	33.53%	
	(978)		(1654)		
Nonfarm	2942	3.03%	3612	2.60%	
	(2551)		(4813)		
All households	1381	37.39%	1714	23.06%	
	(1417)		(2027)		

Table 2. Household economic wellbeing by livelihood

Source: Authors' estimation using data from the 2016-2018 VHLSS.

	2016						2018				
Row	Row mean-Col mean						Row mean-Col mean				
Col		1	2	3	4	5	1	2	3	4	5
	2	-2109					-2635				
		(0.00)					(0.00)				
	3	-1737	372				-1975	660			
		(0.00)	(0.00)				(0.00)	(0.00)			
	4	-1806	303	-69			-1629	1006	346		
		(0.00)	(0.02)	1.00			(0.00)	(0.00)	(0.18)		
	5	-1896	213	-159	-90		-2306	329	-331	-677	
		(0.00)	(0.05)	(0.39)	(1.00)		(0.00)	(0.05)	(0.02)	(0.00)	
	6	-104	2004	1633	1702	1791	15	2650	1990	1644	2321
		(1.00)	(0.00)	(0.00)	(0.00)	(0.00)	(1.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table 3. Comparison of per capita income by livelihood group (Bonferroni)

Note: 1: Formal wage livelihood; 2: Cultivation livelihood; 3: Informal wage livelihood; 4: Non-labour/cultivation livelihood; 5: Diversified agriculture livelihood; 6: Nonfarm livelihood. Mean differences are reported and p-value in parentheses. Source: Authors' estimation using data from the 2016-2018 VHLSS.

				2016				2018			
Row		Row mean-Col mean Row mean-Col mean									
Col		1	2	3	4	5	1	2	3	4	5
	2	-13.50					-12.60				
		(0.00)					(0.00)				
	3	-5.90	12.89				-3.39	15.10			
		(0.00)	(0.00)				(0.01)	(0.00)			
	4	-8.31	4.79	-4.50			-3.70	9.18	-1.21		
		(0.00)	(0.00)	(0.00)			(0.00)	(0.00)	(1.00)		
	5	-9.74	5.72	-6.49	-0.41		-9.03	4.80	-9.12	-5.30	
		(0.00)	(0.00)	(0.00)	(1.00)		(0.00)	(0.00)	(0.00)	(0.00)	
	6	-0.44	13.43	5.54	8.03	9.50	-0.59	12.36	2.76	3.18	8.66
		(1.00)	(0.00)	(0.00)	(0.00)	(0.00)	(1.00)	(0.00)	(0.04)	(0.01)	(0.00)

Note: 1: Formal wage livelihood; 2: Cultivation livelihood; 3: Informal wage livelihood; 4: Non-labour/cultivation livelihood; 5: Cultivation/husbandry/forestry livelihood; 6: Nonfarm livelihood. P-value in parentheses. Source: Authors' estimation using data from the 2016-2018 VHLSS.

Table 5 provides basic information about household characteristics by livelihood. We combined the data for both years because such characteristics as education, demography, and land are slowly changing factors or even fixed in the short-term. It shows that the majority of household heads are male, at 88% for the whole sample. The figure is higher for those in the cultivation or diversified agriculture livelihood groups (about 92%) but lower for those in the formal wage and non-labour/cultivation livelihood groups (81%-78%). About 18% of household heads are of Kinh/Hoa ethnicity. However, the highest level of income is seen in the nonfarm livelihood group (53%), and the lowest in the cultivation livelihood group (5%). This suggests that ethnicity is closely linked with livelihood choice. The average age of the household head is greater for those taking up a non-labour/cultivation livelihood but differs little among those in other livelihood groups. The average household size is larger for those

in the cultivation livelihood group, while the dependency ratio is higher for those following a non-labour/cultivation livelihood.

Table 5 shows that the level of education is particularly low in the Northwest region. On average, about 38% of household heads have had no schooling or did not complete primary education. This figure is much higher for those in the cultivation and diversified agricultural livelihood groups (53% and 45%). Unsurprisingly, those in the formal wage livelihood group attained much higher levels of education than did those in other groups. Table 5 reveals that the mean value of durable assets per household totaled about 26 million VND for the whole sample. However, this value is much higher for those in the nonfarm and formal wage livelihood groups (about 73 and 65 million VND, respectively). The figure for other livelihoods ranges from about 17 million VND (those with an informal wage livelihood) to about 22 million VND (those following a diversified agriculture livelihood).

Table 5. Household characteristics by livelihood

Livelihood group Household characteristics (explanatory varriables)	(1) Full sample	(2) Formal wage	(3) Cultivation	(4) Informal wage	(5) Non-labour/ cultivation	(6) Agricultural diversification	(7) Nonfarm self- employment
Gender (1=male;0=female)	0.88	0.81	0.92	0.86	0.78	0.92	0.87
Ethnicity (1=Kinh/Hoa groups; 0=minorities)	0.18	0.35	0.05	0.20	0.22	0.11	0.53
Age (years)	45.00	46.95	43.58	44.73	49.79	44.59	44.34
	(13.00)	(12.78)	(12.74)	(12.96)	(14.85)	(12.40)	(11.86)
Marital status (1=married;0=single)	0.89	0.89	0.92	0.87	0.79	0.93	0.90
Household size (number of household members)	4.55	4.34	5.00	4.29	3.91	4.84	4.21
	(1.803)	(1.543)	(1.916)	(1.516)	(2.069)	(1.930)	(1.423)
Dependency ratioa	0.37	0.34	0.38	0.36	0.45	0.38	0.35
	(0.239)	(0.215)	(0.219)	(0.231)	(0.316)	(0.237)	(0.222)
No education (1=yes;0=no)	0.38	0.09	0.52	0.32	0.42	0.45	0.16
Primary (1=yes;0=no)	0.26	0.10	0.23	0.29	0.28	0.27	0.31
Lower secondary (1=yes;0=no)	0.26	0.25	0.20	0.30	0.24	0.24	0.34
Upper secondary (1=yes;0=no)	0.08	0.26	0.05	0.08	0.05	0.05	0.15
Post-secondary (1=yes;0=no)	0.03	0.30	0.00	0.01	0.01	0.00	0.04
Farmer association member (1=yes;0=no)	0.58	0.42	0.65	0.58	0.56	0.61	0.46
Communist party member (1=yes;0=no)	0.08	0.38	0.04	0.06	0.05	0.07	0.07
Durable assets (1000 Vietnamese dong)	26157.25	65502.46	17109.84	19704.16	17525.68	22614.98	73185.27
	(60269.5)	(101001.8)	(33307.0)	(24455.7)	(23797.0)	(52035.6)	(150877.3)
Annual cropland (m2)	7524.38	3521.90	16167.20	3471.05	4929.52	7230.74	2594.37
	(9722.9)	(6117.2)	(12440.2)	(4756.1)	(6148.4)	(8245.3)	(4255.9)
Perennial cropland (m2)	743.32	438.62	1694.26	307.55	481.93	489.08	664.90
	(3026.1)	(1690.7)	(5066.9)	(1363.4)	(2120.3)	(2060.7)	(2193.9)
Forestland (m2)	4390.18	2608.26	2384.64	3235.79	3984.43	9140.16	4583.89
	(36711.9)	(8569.5)	(9670.9)	(8540.9)	(13436.7)	(77432.3)	(13075.3)
Aquacultural land (m2)	94.12	98.68	63.67	63.38	56.40	184.18	114.81
	(685.5)	(474.7)	(205.6)	(252.3)	(490.0)	(1343.0)	(544.3)
Household well-being							
Income/person/month (1000 Vietnam Dong)	1548.45	3339.42	949.48	1477.43	1592.53	1216.93	3302.29
	(1758.4)	(1748.6)	(1057.1)	(968.7)	(1854.0)	(1341.2)	(3941.7)
Poverty rate (%)	0.30	0.00	0.53	0.18	0.29	0.39	0.03
Observations	5076	325	1273	1579	473	1069	357

Source: Authors' estimation using data from the 2016-2018 VHLSS. a This ratio is calculated by the number of members aged under 15 and over 59, divided by the number of members aged 15-59.

The average size of annual cropland per household is about 7.525 m² for all households. For those specializing in cultivation (16.167 m²) it is largest, and lowest for those in the nonfarm livelihood group (2.597 m²). Those pursuing other livelihoods also owned a moderate amount of annual cropland. For instance, those in the formal or informal wage livelihood group hold only about 3.521 m² and 3.471 m², respectively. Fittingly, those in the cultivation livelihood group also owned the largest area of perennial cropland. However, the mean area of this land remains rather large among those choosing a nonfarm livelihood compared with the holdings of those in other livelihoods. With respect to forestland, the data also indicate that those pursuing a cultivation livelihood hold the most forestland, followed by those diversifying their livelihood into agriculture.

Overall, the findings suggest that the level of human and social capital is highest for those following a formal wage-earning livelihood, while the level of physical capital (as measured by the value of durable assets) is greatest for those adopting a nonfarm selfemployment livelihood. Those with a cultivation Livelihood Choice and Household Economic Wellbeing in Vietnam's Northwest region

and agricultural diversification livelihood own the largest amount of natural capital (measured by annual cropland) while those following an informal wage-earning livelihood have a significantly lower level of human and natural capital. The findings here suggest that holding some types of household capital may be closely associated with livelihood choice in the region.

4.1. Econometric results of factors associated with livelihood choice

The regression estimates for parameters related to livelihood choice are shown in Table 6. We used the pooled data of both years while accounting for the year dummy variable. This method allows us to get a bigger sample size while the year dummy captures time trends (Wooldridge, 2016). The results are expressed as coefficients, which are then interpreted using relative risk ratios (RRR), which are the exponentials of the coefficients (Train, 2003). It should be noted that the results in Table 6 show that many explanatory variables are statistically highly significant, and the Pseudo R squared value is 0.25, indicating that the model has considerable explanatory power (Scarpa et al., 2003; Louviere et al, 2000).

Explanatory variables	Formal wage vs cultivation	Informal wage vs cultivation	Non-labour/ cultivation vs cultivation	Diversity vs cultivation	Nonfarm vs cultivation
Gender	-0.58	0.01	-0.24	0.04	0.01
	(0.430)	(0.338)	(0.407)	(0.322)	(0.466)
Ethnicity	-0.24	0.14	0.18	0.23	0.84**
	(0.426)	(0.332)	(0.338)	(0.324)	(0.370)
Age	0.03**	-0.01	0.02***	0.01	-0.01*
	(0.010)	(0.006)	(0.006)	(0.005)	(0.009)
Marital status	0.15	0.01	0.12	0.43	0.05
	(0.462)	(0.346)	(0.398)	(0.337)	(0.483)
Household size	0.26***	0.11**	-0.16**	0.03	0.19***

Table 6. Multinomial logit estimates for factors associated with livelihood choice

Explanatory variables	Formal wage vs cultivation	Informal wage vs cultivation	Non-labour/ cultivation vs cultivation	Diversity vs cultivation	Nonfarm vs cultivation
	(0.062)	(0.043)	(0.064)	(0.055)	(0.061)
Dependency ratio	-1.81***	-0.67**	0.37	-0.35	-0.93**
	(0.492)	(0.277)	(0.338)	(0.352)	(0.399)
Primary	0.84**	0.34**	0.02	0.18	0.73**
	(0.383)	(0.139)	(0.192)	(0.148)	(0.293)
Lower secondary	1.37***	0.44***	0.18	0.24	0.75**
	(0.337)	(0.165)	(0.224)	(0.160)	(0.303)
Upper secondary	2.85***	0.47*	0.28	-0.00	0.99**
	(0.440)	(0.246)	(0.351)	(0.260)	(0.386)
Post-secondary	383.75***	2.06*	1.53	1.03	2.36*
	(1.231)	(1.203)	(1.291)	(1.223)	(1.343)
Farmers' association	-0.39	-0.06	0.01	-0.04	-0.14
	(0.238)	(0.120)	(0.156)	(0.125)	(0.187)
Communist party	0.95***	0.45	0.16	0.35	0.06
	(0.358)	(0.301)	(0.336)	(0.263)	(0.392)
Assets	1.07***	0.18***	0.14*	0.20***	1.13***
	(0.108)	(0.065)	(0.079)	(0.071)	(0.127)
Annual cropland	-1.08***	-1.01***	-0.87***	-0.78***	-1.14***
	(0.165)	(0.155)	(0.159)	(0.146)	(0.159)
Perennial cropland	-0.16***	-0.17***	-0.14***	-0.15***	-0.16***
	(0.042)	(0.031)	(0.034)	(0.035)	(0.041)
Forestland	-0.00	0.00	0.00	0.07***	-0.03
	(0.036)	(0.023)	(0.033)	(0.027)	(0.029)
Aquacultural land	-0.11	0.01	-0.04	0.06**	0.06
	(0.070)	(0.026)	(0.042)	(0.029)	(0.039)
Transportation	0.34	0.12	0.03	0.02	0.91***
	(0.325)	(0.224)	(0.271)	(0.255)	(0.251)
Natural disaster	0.08	0.16**	0.15*	0.00	0.09
	(0.101)	(0.074)	(0.081)	(0.088)	(0.091)
Trade village	-1.43	-1.57	-2.08*	-0.23	-2.11
	(2.361)	(1.697)	(1.139)	(1.055)	(1.696)
Local market	-0.48*	-0.27	-0.21	-0.34	0.09
	(0.291)	(0.226)	(0.241)	(0.242)	(0.265)
Poor commune	0.41	-0.05	0.36	0.27	0.20
	(0.303)	(0.233)	(0.250)	(0.247)	(0.285)

Province dummies (controlled)

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Articles

Formal wage vs cultivation	Informal wage vs cultivation	Non-labour/ cultivation vs cultivation	Diversity vs cultivation	Nonfarm vs cultivation
-5.00***	7.28***	4.44***	3.53***	-3.75**
(1.608)	(1.295)	(1.380)	(1.319)	(1.604)
0.24				
0.00				
5,076	5,076	5,076	5,076	5,076
	Formal wage vs cultivation	Formal wage vs cultivation Informal wage vs cultivation -5.00*** 7.28*** (1.608) (1.295) 0.24 0.00 5,076 5,076	Formal wage vs cultivation Informal wage vs cultivation Non-labour/ cultivation vs cultivation -5.00*** 7.28*** 4.44*** (1.608) (1.295) (1.380) 0.24 0.00 5,076 5,076	Formal wage vs cultivationInformal wage vs cultivationNon-labour/ cultivationDiversity vs cultivation-5.00***7.28***4.44***3.53***(1.608)(1.295)(1.380)(1.319)0.240.0010005,0765,076

Note: Estimates are adjusted for sampling weights and clustered at the commune level. Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1.

As can be seen in Table 6, households whose head belongs to the Kinh/Hoa ethnic majority are more likely to pursue a nonfarm livelihood. Specifically, holding all other variables constant, the likelihood of choosing a nonfarm livelihood is about 2.32 times higher for a household whose head belongs to the ethnic majority¹. Larger households are more likely to choose a livelihood based on wage-paying work (informal or formal wage work) or nonfarm activities. Similar effects are also found for households with a greater dependency ratio. In general, the findings suggest that these are labor-intensive activities rather than a cultivation livelihood.

With respect to the role of human capital in livelihood choice, the results in Table 6 support previous findings that better education enables rural households to pursue livelihoods affording higher returns. For instance, the likelihood of adopting a formal wage livelihood is 3.94 times higher for households whose head completes primary education than for those whose head lacks | level variables have a significant effect on

formal education. The same trend is also found with larger effects at higher levels of education. The RRRs are 3.93, 17.29 and 383.75 times greater for lower secondary, upper secondary and above upper secondary education levels, respectively. Similar effects are also observed for the choice of informal wage-paying and nonfarm livelihoods.

The coefficients of the annual and perennial cropland variables are negative and statistically highly significant, suggesting that holding more cropland increases the probability of households specializing in cultivation for their livelihood, rather than pursuing other livelihoods. For instance, a 10% increase in the size of annual cropland reduces the relative probability of households choosing a nonfarm livelihood by about 10.3%², holding all other factors in the model constant. However, households with more forestland or aquacultural land are more likely to adopt a diversified agricultural livelihood.

Finally, we find that some commune-

¹ The RRR is calculated as exp (0.84*1) = 2.316367=2.32 which means that the relative probability of choosing a nonfarm livelihood is 2.32 times higher for Kinh/Hoa households than for ethnic minority households.

² We can obtain the RRR by exponentiating the coefficient for a variable, for instance the log of annual cropland in Table 6. For a 10% increase in the area of annual cropland, the corresponding logarithm difference for annual cropland is log (1.01) = 0.09531. The relative likelihood of choosing a nonfarm livelihood would decline by about 10.3%. This can be calculated in terms of exponential function as exp (-1.14*0.09531)-1 =-.10295872 \approx -10.3%.

livelihood choice. The relative probability of choosing a nonfarm livelihood is 2.5 times higher for households in communes with access to transportation. We also find that living in communes subject to natural disasters increases the likelihood of households choosing an informal wage or non-labour/ cultivation livelihood. Specifically, a natural disaster increases the relative probability of households pursuing an informal wage livelihood by about 17%.

5. Discussion

Our findings are in line with most studies on rural Vietnam and other developing countries, which confirm the importance of education in securing a better livelihood. For example, households with higher levels of education are more likely to adopt a formal wageearning livelihood in the Mekong Delta region (Hoang et al., 2019) and Hanoi's peri-urban areas (Tran et al., 2014). Better education also increases the likelihood of rural households choosing profitable nonfarm livelihoods in Bhutan (Mottaleb & Ali, 2018), China (Zhao & Barry, 2014), Bangladesh (Rahman & Akter, 2014), and several other developing countries (Tran, 2014).

Regarding the link between some household characteristics and livelihood choice, our research results differ from those of Tran et al. (2014) concerning Hanoi's peri-urban areas, where farming livelihoods tend to be more labor-intensive than other nonfarm livelihoods. Also, our study reveals that ethnic minority households are less likely to adopt remunerative livelihoods in the region. Similar findings are also reported in the North Central region (Van Hoang et al., 2020).

We find that household ownership of durable assets is closely linked with a greater likelihood of choosing non-cultivation livelihoods. Particularly, regarding the role of natural capital in shaping rural livelihood, our findings accord with most previous studies on Vietnam (Hoang et al., 2019; Tran et al., 2014) and several developing countries (Rahman & Akter, 2014; Rigg, 2006; Zhao & Barry, 2014; Babulo et al., 2008; liyama, 2006; Jansen, Pender, Damon, & Schipper, 2006; Fazal, 2001), which have found that owning more farmland encourages rural households to specialize in farming activities as their main source of income and therefore reduces the motivation for nonfarm diversification.

With respect to the contextual factors that can influence livelihood choice, our research finding is similar to that for the Mekong Delta region (Hoang et al., 2019) and some other developing countries, such as peri-urban India (Arif et al, 2019), Bhutan (Mottaleb & Ali, 2018) and Bangladesh (Rahman & Akter, 2014), which confirms the importance of public rural infrastructure (access to roads and transportation) for nonfarm diversification. Also, our findings concerning the effect of natural disasters on livelihood choice suggest that natural disasters act as a push factor prompting rural households to diversify out of crop farming activities in rural areas. The same trend is also found in Nicaragua (Van den Berg ,2010) and India (Ghosh & Ghosal, 2021).

6. Conclusion and policy implications

The main aim of the current study has been to examine factors associated with livelihood choice in the Northwest region, the poorest region, where ethnic minorities account for most of the population. Our study employs cluster analysis to provide a detailed picture

of household livelihood strategies in the region. At the household level, six livelihood groups have been identified. The findings of Bonferroni pairwise testing show that whereas formal wage-paying and nonfarm livelihoods yield the highest returns, the cultivation livelihood yields the lowest. Moreover, the poverty rate is the lowest for the former and highest for the latter. The results confirm that households pursuing an informal wage livelihood tend to earn higher income and are less at risk of poverty than those specializing in cultivation.

Our econometric findings demonstrate relationship between negative land а endowment and nonfarm or wage-earning livelihood choices. This shows that households with less land are more likely to pursue highreturn livelihoods (wage-earning or nonfarm livelihoods). As a result, landlessness or land shortage is not an admissible impediment to households choosing profitable livelihoods in the Northwest region. Our research findings support the view that increasing the number of land-limited farmers or decreasing land availability can be viewed as a positive trend in some cases, since it allows rural households to diversify their livelihood choices and reduce their reliance on land.

In particular, our findings show that households with better education are more likely to engage in profitable non-farm activities, such as wage-earning or nonfarm livelihoods. This study shows that land is no longer so important in determining rural livelihoods, and that other factors, such as education and skills, have gradually taken over. As a result, a land distribution policy should not be considered the primary strategy for eradicating rural poverty in the region. Our research findings show that among other factors, any level of education has that lead to poverty elimination (Adato, Carter,

a great potential to enable households to choose wage or nonfarm livelihoods, which are much more profitable activities. Poorly educated households today may be the result of limited access to education in the past or poorly educated parents. This situation in turn may lead to poor education for offspring in the future, resulting in poverty transmission across generations. Given the importance of education, as demonstrated by our research, government policies aimed at improving the access of poor households to education should be promoted further in the Northwest region.

According to our research, some specific commune characteristics appear to be crucial in encouraging the choice of high-return livelihoods. A commune where transportation is available enhances opportunities for local households to choose a nonfarm livelihood, earning much higher income than does a livelihood dependent on crop cultivation. This implies that local governments can provide a favorable environment for local households to move or diversify their livelihoods towards more profitable activities by upgrading local infrastructure (e.g., road access to communes) and encouraging local transportation.

We acknowledge that our research has certain limitations. First, income has long been the preferred unit of welfare study because it is both simple to comprehend and use in quantitative research (Caroline & Andrew, 2007). However, income data often suffers from measurement errors, especially in developing countries. An alternative assetbased approach, outlined by Sahn and Stifel (2003) using assets and their accumulation, aims to supplement such metrics by deepening our awareness of poverty's multifaceted nature and the complexities of the processes

& May, 2006). This suggests that future research should calculate asset indices as a significant supplement to pure income data because they provide a fuller picture of the methods adopted by households at various income levels to acquire various kinds of assets, at the same time providing clues to poverty reduction (Caroline & Andrew, 2007). Secondly, livelihood choice may be determined by unobserved factors. This suggests that future studies should account for this issue by using an instrumental variable estimator or randomized control trial approach.

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Appendix 1

Number of clusters	Calinski/ Harabasz pseudo-F
2 3 4 5 6 7 8 9 10 11 12 13 14 15	1703.60 2160.79 1821.53 3516.33 3042.31 2997.16 2625.81 2501.34 2229.31 2288.99 2130.36 2005.02 1931.20 1798.38

Appendix 2: Livelihoods by year

Livelihoods	Full sample	2016	2018
Formal wage	0.06	0.06	0.07
Cultivation	0.25	0.26	0.24
Informal wage	0.31	0.29	0.33
Non-labour/cultivation	0.09	0.10	0.09
Cultivation/husbandry/forestry	0.21	0.22	0.20
Nonfarm	0.07	0.07	0.08
Observations	5076	2522	2554