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Factors Affecting Nonfarm Income Diversification among Rural Farm Households in Central Nepal

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Abstract

Nonfarm activities play an important role in the determination of rural household income, consumption expenditure, and household food security. However, much less studies have been devoted to the factors that influence nonfarm income diversification by farm household in developing countries. Using cross-sectional data and a probit model, this study attempts to determine the factors influencing nonfarm income diversification decisions by farm households in Central Nepal. The result reveals that household characteristics such as age, gender and education of the household head, and family size play a significant role in nonfarm work decisions. The households with larger farm size are less likely to participate in nonfarm work than their counterpart. Additionally, for those remains in the rural households, distance to road and market hinders the opportunities for nonfarm work. Finally, regional differences also exist in participating nonfarm activities among farm households. This study suggests that government policy should pay more attention on education, gender and infrastructures such as road and markets, to reduce the entry barriers and facilitate easier access to nonfarm activities. Also, nonfarm activities need to be promoted and incorporated in governmental plans and policies for balanced development between hills and terai areas.

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INTRODUCTION

Benefits from nonfarm employment opportunities have influenced the poor directly by raising incomes of households and indirectly by increasing agricultural production through the investment in new technology and high-yielding crop varieties. Therefore, many rural farm households tend to diversify their source of income by involving in nonfarm activities. Income diversification via nonfarm work is associated with higher and stable incomes and food consumption over the years (Reardon *et al.*, 1992). There is an obvious connection between income diversification through nonfarm work and food consumption among farm families in developing countries. For example, Anderson (2002) notes that off-farm income is extremely important to the household livelihood in many developing nations and essential to food security among farm households. Specifically, households with nonfarm work will have a better chance to reallocate their labor and can more efficiently offset the negative price effect on their food security compared to those who have fewer nonfarm options (Chang and Mishra, 2008). Lanjouw and Lanjouw (2001) note that rural nonfarm sector can contribute to economic growth, rural employment, and poverty reduction. Further, Chang and Mishra (2008) find that households with more access to income generating activities or access to higher paying work have higher income and more food secure than households who do not have these benefits.

The poorer, in the rural areas tend to depend more heavily on food-crop production and seasonal wage labor activities for their incomes and are therefore likely to be vulnerable in face of personal (such as illness) and covariate shocks such as droughts. On the other hand, the relatively well-offs have better access to productive assets (such as land and human capital) and use their superior asset endowment to engage in livelihood strategies that offered higher returns and lower risks and are able to escape poverty. Therefore, on-farm investments must necessarily be integrated with nonfarm investments to enable households generate sufficient incomes to escape out of poverty (Karugia *et al.*, 2006). For example, Olale and Henson (2012) provide an evidence of poverty reduction among fish

farmers in Kenya by spreading income risk, expanding incomes and relieving the pressure exerted on fish resources. Many researchers (e.g. Abdulai and CroleRees, 2001; Abdulai and Delgado, 1999; Barrett *et al.*, 2001; Reardon *et al.*, 1992; Woldenhanna and Oskam, 2001; Wouterse and Taylor, 2008) have conducted similar studies in the past. With the realization of this milieu, government from developing countries had hammered out more pro-farmer strategies with the support from donors and international support organizations but very little has been achieved so far.

Despite the evidence of the important of non-farm sector to rural farm households, there has been little systematic study on the determinants of nonfarm work decision by farm households (Reardon, 1997). Additionally, far less attention has been paid to infrastructure related issues that influence nonfarm work opportunities and unknown about how much and why rural farm households diversify their sources of income into the nonfarm sector. In order to fill this research gap, this study investigates the determinants of nonfarm income diversification decisions among rural farming communities in Nepal particularly from two main agro-climatic zones (hills and tropical terai) of Central Nepal. This endeavor is important not only because it serves to bridge a gap in the income diversification and household welfare literature, but also because a better understanding of the situation that facilitates the design and implementation of effective policies to promote the benefits of non-farm sector and minimize the potential costs. The organization of the paper is as follows: First, we present materials and methods in the next section under which we explained data and variables, and the econometric framework. Next part describes in details the results of the analysis. Finally, we ended up with conclusions and some policy implications.

Non-farm sector in Nepal

Non-farm economic activities of rural households in Nepal have increased over the last two decades (CBS, 2011). As shown in Figure 1 that 37.2 % of the total household income comes from non-farm sector in 2010/11 while it was only 22% in 1995/96. On the other hand, share

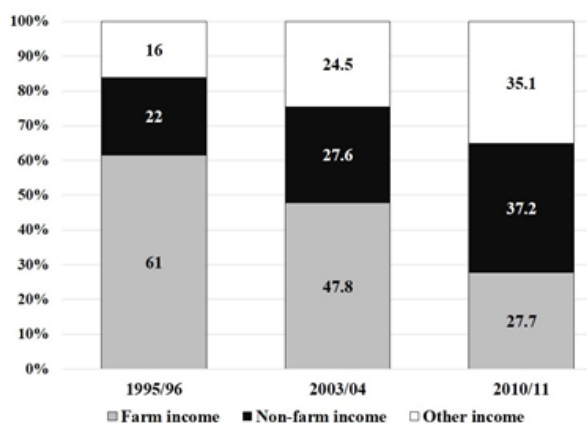


Figure 1: Share of farm, non-farm and other income in total household income. (Source: CBS, 2011)

of farm income in total household income decreased from 61 % to 27.7 % in the same period. The proportion of male wage-earners participated in non-farm activities was 76 % whereas this figure for female was only 45%. Among others, central region has the highest proportion of non-farm participant (39 %) and the percentage share of non-farm income in total household income was 41.5 % which is the highest among regions.

Agriculture sector constitutes 35% of the wage employment and the remaining is accounted by non-agriculture sector. Roughly about 35% of households in 1995/96 had involved in some kind of non-farm activities and this proportion was higher in urban areas relative to rural areas (CBS, 2011). Besides, the highest proportion of households in urban terai areas is operating non-farm activities and the lowest proportion is in the rural mid and far western hills. The majority of the non-farm enterprises in urban areas are in trade sector while manufacturing sector is dominant in rural areas. About 50% of enterprises in rural areas of the central, western and far western hills are in manufacturing sector. Households from the poorest consumption quintile have disproportionately higher share of manufacturing enterprises while those from the richest quintile have trade and services as the dominant type (CBS, 2011).

MATERIALS AND METHODS

Description of the study area

Nepal located in South Asia between 26° 22' to 30° 27' N latitude and 80° 4' to 88° 12' E longi-

tude, is a landlocked country bordered with China in the north and India in the east, west and south (MOAD, 2011). Nepal covers a total area of 147,181 square kilometers. Topographically, Nepal is divided into three regions: the Himalaya to the north, the Hills in the middle and the Terai to the south. The study was conducted in four districts of Central Nepal namely Kavre, Nuwakot, Chitwan and Rautahat. These districts represent a wide range of agro-ecological variability and are located at an altitude of between 150 and 2500 meters above sea level. Out of eight districts, Kavre and Nuwakot were selected from the hill region; while Chitwan and Rautahat were selected from the tropical plain terai region that represents seven districts (Figure 2).



Figure 2: Map of Nepal showing study area (Source: MOAD, 2011)

With the highest percentage of nonfarm work participation, the central region contributes the highest share in total household income from nonfarm sector in comparison to other regions (CBS, 2011). Moreover, selected districts from Central Nepal are benefited with different infrastructures such as road and market networks, business and industry, credit institutions, and potential for agriculture. Because two hilly districts Kavre and Nuwakot are close to the capital city Kathmandu (30 km east and 40 km northwest of the capital city, respectively), there are more nonfarm job opportunities for those residing in the hill districts. Similarly, terai districts (Chitwan and Rautahat) contain mainly of plain areas with easy access to road and markets, and these districts are bordered to India that is an additional benefit to those living in terai in terms of nonfarm job opportunities. Moreover, there

was no prior study on nonfarm income diversification conducted in this area.

Econometric model

The farm households are assumed to maximize their utility function subject to constraint resources (Asfaw *et al.*, 2012). The households choose to work nonfarm sector if the utility gained from participating in nonfarm activities is greater than the utility from not participating. Following Ahearn *et al.* (2006) and Gould and Saupe (1989), we used a probit model to determine the probability of choosing nonfarm work by farm households. In probit model, dependent variable is binary which is suitable to determine the probabilities of each households to participate in nonfarm activities. Lass and Gempesaw (1992) and El-Osta *et al.*, (2004) also used a probit model in similar studies in the past.

A household decides to work off the farm only if the market wage (W_i) is higher than its reservation wage (W_i^r) for farm and leisure time. A farm household's decision to work off the farm can be expressed in the framework of a discrete choice model. The specification of this model is:

$$Y_i^* = X_i' \beta_i + \epsilon_i, Y_i = 1 \text{ if } w_i > w_i^r; Y_i = 0 \text{ otherwise} \quad (1)$$

where $\epsilon \sim N(0, 1)$. Then Y can be viewed as an indicator for whether this latent variable is positive:

$$Y_i = \begin{cases} 1 & \text{if participated in nonfarm work,} \\ 0 & \text{otherwise.} \end{cases}$$

where, Y_i^* is the latent variable which represents the probability of the household to work in the nonfarm sector and takes the value 1 if the household receives higher wage (w_i) than their reservation wage (w_i^r), 0 otherwise. X_i' represent covariates that are associated with the decision to work off the farm, β_i is the coefficient of covariates, ϵ_i is vector of error terms. Variables that increase the nonfarm wage rate increase the probability of nonfarm work and vice versa for variables that decrease the nonfarm wage rate (Ahearn *et al.*, 2006). Marginal effects (ME) assess the influence of each independent variable on the decision of the farm household to participate in nonfarm work as following

(Greene, 2012, p. 693):

$$\frac{\partial E[Y_i^* | X_i]}{\partial X_i} = \phi(X_i' \beta) \beta \quad (2)$$

Based on the theoretical model and experiences of the previous studies (e.g. Ahearn *et al.*, 2006; Chang and Mishra, 2008; Conley and Udry, 2010; Doss and Morris, 2000; El-Osta *et al.*, 2008; Uaiene *et al.*, 2009), we selected our independent variables and specified empirical model as follows:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + \beta_{10} X_{10i} + \beta_{11} X_{11i} + \beta_{12} X_{12i} + \epsilon_i \quad (3)$$

where, Y_i = Binary dependent variable, X_{1i} = Age of household head in years, X_{2i} = Male dummy, X_{3i} = Formal years of schooling (years), X_{4i} = Household size, X_{5i} = Farm size (ha), X_{6i} = Extension visits (number per year), X_{7i} = Participation in farmers group or cooperatives (dummy), X_{8i} = Distance to market (km), X_{9i} = Access to seed (dummy), X_{10i} = Access to agricultural credits (dummy), X_{11i} = Distance to nearest road (km), X_{12i} = Region dummy, β_0 to β_{12} = Coefficients to be estimated, and ϵ_i = error term.

Data and definition of variables

The main source of data for this study originates from a survey conducted on a sample of farm households in central region of Nepal during June – August, 2013. A multistage, random sampling technique was used to select the sample. At the first stage, four districts namely Kavre and Nuwakot from hill region, and Chitwan and Rautahat from tropical plain terai region of central Nepal were purposively selected. At the second stage, a total of 8 villages (2 villages from each district) were selected. Subsequently, two wards were randomly sampled in each of the selected village resulting in a total of 16 wards. This was followed by a random sampling of 26 farm households from each ward in proportion to the population size in each ward. A total of 416 farm households in four districts were surveyed using the standardized survey questionnaire. The number of sampled households and their nonfarm work participation status by region are reported in table 1.

In this paper, participants are classified as households who participate any of nonfarm ac-

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Table 1: Number of sample households surveyed and their nonfarm work participation categories by region.

Region	Nonfarm work participation status		Regional total
	Group A	Group B	
Hill region	136 (45.18%)	72 (62.61%)	208 (50%)
Terai region	165 (54.82%)	43 (37.39%)	208 (50%)
Total by status	301 (72.36%)	115 (27.64%)	416 (100%)

Note: Group A=Participant in nonfarm work, Group B= Non-participant in nonfarm work.
(Source: Author's survey, 2013)

tivities irrespective of income they earn, and non-participants are those who did not participate in nonfarm work. Many participants did not fully allocate their time to nonfarm work as they also get involved in farming. However, increasing trend of searching nonfarm employment opportunities cannot be undermined as this shares the significant amount of household income in developing countries. Therefore, our main interest in this paper is to see whether farm households' socio-economic and other characteristics affect the decision to participate in nonfarm enterprise. For this, the participation decision is modeled here as binary variable at the household level like other previous studies (e.g. Ahearn *et al.*, 2006; Chang and Mishra, 2008; El-Osta *et al.*, 2008).

The demographic information for each household includes the age, gender and education of the household head and family size were in-

cluded in the model. Other household characteristics, such as how much land a household owns, whether a household has seed and agricultural credit access, as well as infrastructure and services received such as how far a household is from the nearest road and market and number of contacts or visits with extension officers were additional variables included. Further details of explanatory variables for the regressions are identified in the following section (Table 2). The choice of explanatory variables and its expected signs are explained in more detail as following.

The age of household head is incorporated as it is believed that with age, people accumulate experience as well as more personal capital and, thus, show a greater likelihood of investing in nonfarm enterprise. However, it may also be that younger household heads are more progressive and flexible with situation and hence

Table 2: Definition and summary statistics of selected variables.

Variables	Description	Mean	S.D.
Dependent			
Nonfarm work participation	=1 if household participated in nonfarm work, 0 otherwise	0.72	0.45
Independent			
Age	Age of household head (years)	44.54	10.81
Male dummy	=1 if the head is male, 0 otherwise	0.70	0.46
Education	Years of formal education, head	7.86	3.38
HH_size	Number of household members	5.83	1.98
Farm_size	Area cultivated by household in current year (ha)	0.56	0.27
Ext_visits	Number of extension visits received per year	6.80	6.09
Partici_group	=1 if participated in farmers group and cooperatives, 0 otherwise	0.73	0.44
Dist_mrkt	Distance to input/output market (km)	13.14	6.38
Seed_access	=1 if seed is available at local store, 0 otherwise	0.59	0.49
Agcredit_access	=1 if access to agricultural credit, 0 otherwise	0.45	0.49
Dist_road	Distance to main nearest road (km)	0.40	0.89
Region_dummy	=1 if household reside in terai region	0.50	0.50

(Source: Author's survey, 2013)

likely to take participation decision faster (Olale and Henson, 2012). The expected sign of the coefficient on age is indeterminate. A dummy variable for gender of the household head is included to capture gender difference which takes the value of 1 if the head of the household is male, and 0 if female. It has been argued by some authors that women are generally discriminated against in terms of access to external inputs and information (Doss and Morris, 2000). This hypothesis implies that males are more likely to participate in nonfarm work than females. More educated farmers are typically assumed to be better able to process information and search for appropriate nonfarm work opportunity. The belief is that education gives farmers the ability to perceive, interpret and respond to new information much faster than their counterparts without education (Huffman, 1980; Uaiene *et al.*, 2009). Hence, the expected sign on the coefficient on education is positive.

Size of household is another variable used in model. A large family often has a large number of working members. Generally, an increase in family size is likely to increase the probability of participation. The expected sign for household size is positive. The land area cultivated by the family farm is often argued as an important factor in affecting farm work decision positively and nonfarm work decision negatively (Chang and Mishra, 2008). It is frequently argued that farmers with larger farms are more likely to adopt an improved technology particularly in trying new varieties of seed compared with those with small farmers as they can afford to devote part of their fields to try out the improved technology. Therefore, the expected sign on the coefficient on farm size is negative.

Farmers' contacts with extension agents were measured by number of extension visits per year. Contact with extension agents is expected to have a positive effect on adoption of new agricultural technologies based upon the innovation-diffusion theory. Such contacts, by exposing farmers to availability of information can be expected to stimulate adoption (Polson and Spencer, 1991). Thus, a negative relationship is hypothesized between extension visits and the probability of participating in nonfarm activities. Membership to a

farmers group and cooperatives is included because it has been shown that farmers within a group learn from each other how to grow and market new crop varieties. As discussed, the evidence suggests that network effects are important for individual decisions, and that, in the particular context of agricultural innovations, farmers share information and learn from each other (Andrew and Rosenzweig, 1995; Conley and Udry, 2010). The expected sign on the coefficient on membership in farmers group and cooperatives is negative in the context of nonfarm activities rather than farm activities.

Distance to road and market for nonfarm job opportunity is assumed to play an important role in finding nonfarm work opportunities. The hypothesis here is that, the further away a household is from road, the smaller is the likelihood that they will participate in nonfarm employment. Labor markets are also known to influence the probability of participation decision. Thus, the coefficients on the distance of the household to the nearest road and markets are expected to be negative (Beyene, 2008). Access to seed is another important variable included which takes on a value of 1 if the household has access to seed in local market, 0 otherwise. It is expected that the availability of improved seed is more likely for farmer to engage more on farming. Hence, the expected sign on the coefficient on easy access to seed is also negative. To reflect unobserved regional differences, the location of the farm household is specified as a dummy to indicate whether the respondent lives in terai region.

RESULTS AND DISCUSSION

Descriptive statistics

Descriptive statistics and explanation of the variables used in the study are provided in table 2. As observed in the table, 301 (72%) of the total sample households participated in nonfarm activities. The average household size was 6 persons which is consistent with the national average in Nepal (CBS, 2011). The average age of respondents was 44.5 years and the majority (70%) of the sample households was headed by male which is expected in Nepali context. Similarly, the mean years of formal education of household head was found

Table 3: Characteristics of nonfarm work participants and non-participants.

Variables	Group A	Group B	Difference (A-B)	t-value
Age of Household head (years)	43.75	46.62	-2.87	-2.44**
Gender of household head male (%)	0.74	0.62	0.12	5.43**
Years of schooling of household head				
Household size (number)	8.13	7.16	0.97	2.63***
Farm size (ha)	5.87	5.70	0.17	0.78
Number of extension visits per year	0.45	0.68	-0.23	-4.95***
Participation in farmers group or cooperatives (dummy)	6.59	7.36	-0.77	-1.15
Access to improved seeds of crop varieties and vegetables (dummy)	0.72	0.76	-0.05	-0.96
Distance to nearest input/output market (km)	12.14	15.76	-3.62	-5.34***
Access to agricultural credit (dummy)	0.44	0.47	-0.03	-0.26
Distance to nearest main road (km)	0.31	0.65	-0.35	-3.57***

Note: Group A=Participant in nonfarm work, Group B= Non-participant in nonfarm work.
 *** P < 0.01, ** P < 0.05 confidence level.

to be 7.8 which is also comparable to national average of 8.1 years for adults (CBS, 2011). The average farm size of 0.56 hectare is comparable to the national average of 0.6 hectare (MOAD, 2011). Amongst the households, majority (73%) had participated in farmers' group and cooperatives, and 45 % had reported to have access to agricultural credits from bank and local saving and credit cooperatives. Furthermore, farmers, on average, had 6.8 contacts or visits with extension technicians per year. The average distance to nearest market and main road head from household is 13.14 km and 0.40 km respectively.

Table 3 presents results of statistical significance tests on equality of means for continuous variables and equality of proportions for binary variables for participants and non-participants. There appear to be a significant difference in age and gender of household head between non-farm work participants and non-participants. There is also a significant difference in the years of schooling of the household heads among the two groups, with the participants being younger and educated.

Farm size shows significant difference between nonfarm work participants and non-participants, suggesting that higher the farm size, lower the participation in non-farm activities. Further, access to seed by farm households, distance to main road and nearest market also show significant differences between these two groups. In contrast, household size, number of

extension visits per year, participation in farmers' group and cooperatives, and access to agricultural credit did not show significant differences.

Nonfarm work decisions by farm households

The results of estimated probit model are presented in table 4 which represents the propensity to work off the farm by rural farm households. Some of the variables have significant effects on the probability to work off-farm and are in agreement with some of the findings in previous studies. For instance, demographic and household characteristics appears to be important in nonfarm work decisions. The results indicate that age and education are statistically significant in influencing the probability of working nonfarm sector. Similar to previous findings by Chang and Mishra (2008); Mishra and Goodwin, (1997) and Huffman and Lange (1989), the results suggests that the more educated the household head is, the more likely the household will participate in nonfarm work possibly because they are qualified and can better process information more rapidly than otherwise. As expected, the probability of working off the farm is negatively influenced by age. This negative relationship shows that older farmers are less likely to participate on nonfarm activities. The households headed by male are more likely to participate in nonfarm employment. This result is supported by positive and statistically significant coefficient of the variable male_dummy.

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Table 4: Probit estimates of nonfarm employment decisions.

Variables	Parameter estimates	t-value	Average marginal effects
Age	- 0.019 (0.008)	- 2.23**	-0.005
Male dummy	0.395 (0.163)	2.42**	0.106
Education	0.102 (0.031)	3.34***	0.027
HH_size	0.154 (0.044)	3.45***	0.041
Farm_size	- 1.602 (0.383)	- 4.18***	-0.428
Ext_visits	- 0.002 (0.017)	- 0.12	-0.001
Partici_group	- 0.213 (0.230)	- 0.92	-0.057
Dist_mrkt	- 0.031 (0.013)	- 2.34**	-0.008
Seed_access	- 0.204 (0.185)	- 1.10	-0.054
Agcredit_access	- 0.008 (0.171)	- 0.05	-0.002
Dist_road	- 0.158 (0.088)	- 1.80*	-0.042
Region_dummy	0.494 (0.187)	2.64***	0.132
Constant	1.199 (0.577)	2.08**	
Log-likelihood		- 197.9107	
Pseudo R ²		0.1930	
LR Chi ² (12)		94.69	
Correctly classified		0.0000	
		76.68 %	

Note: *** p<0.1, ** p<0.05 and * p<0.1. The number in the parentheses next to the parameter estimate is the standard error.

In order to assess the impact of farm size on the probability of nonfarm work decision, total land area cultivated by households (Farm_size) was included in the regression model. Farm size is negative and significant factor for diversifying nonfarm income sources among rural farm households in Nepal. The result is consistent with [Chang and Mishra \(2008\)](#). Size of household is an important variable that impacts nonfarm work. In this study, household size is found to be positively and significantly associated households' nonfarm work decision. This implies that as the number of household member increases, probability of working off the farm also increases which is consistent with expectations. Further, distance to road (Dist_road) and nearest market (Dist_mrkt) has negative impact on the probability of nonfarm employment by farm household. This implies that farther the household from main road and market, lower the probability to involve in nonfarm work. This result is consistent with [Babatunde and Qaim \(2010\)](#).

Finally, nonfarm work appears to be substantially influenced by regions. Farm households located in tropical plain terai region are more likely to participate in nonfarm work in comparison to those located in hilly areas. The infrastructures (such as road and market network) in

terai region possibly capture the opportunities in the non-farm sector available to farm households. Average marginal effects shown in column 4 of table 4 indicate the individual effect of each independent variable for the decisions of nonfarm work by farm households.

CONCLUSIONS

In spite of mounting evidence of the importance of the nonfarm sector to rural farm households, there has been little systematic study on rural nonfarm diversification as a major component of rural nonfarm activity. Using data from a household survey and a probit model, this study investigates the determinants of nonfarm income diversification decisions by farm households, particularly from two main agro-climatic regions (hills and tropical plain terai) of Central Nepal. In our study, we included mainly the household characteristics, institutional and infrastructure related variables.

The empirical results reveal that the household characteristics such as age, gender and education of the household head and household size to be influencing factors for nonfarm work decisions. Farm size is negative and significant factor for diversifying nonfarm income sources, suggesting that larger the farm size smaller the

likelihood to participate in nonfarm work. Further, infrastructures related variables play significant role in participating nonfarm activities in rural areas. Finally, nonfarm work appears to be substantially influenced by regions. Farm households living in tropical plain terai region are more likely to participate in nonfarm work in comparison to their counterparts residing in hill region. This possibly captures the availability of nonfarm job opportunities in plain terai areas.

The study, at the policy level, suggests that major attention should be given to build infrastructures such as road networks and market in the rural areas that helps promote nonfarm enterprise, overcome the entry barrier and make it accessible for rural farm households. Also, nonfarm activities need to be incorporated in governmental plans and policies for balanced development between hill and tropical plain terai districts. Finally, programs that encourage women to participate in nonfarm activities should be in place in order to overcome the gender bias, and improve the educational status of farming households are necessary to enhance nonfarm income sources in the long run.

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