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Farming Systems in High Hills of Rural Nepal: Characterization and Its Determinants

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ABSTRACT: The rural agriculture of Nepal has a number of essential traits, including a diverse and integrated farming system. In 2019, a study was done in the Ghaghara/ Karnali river system in the northwest part of Nepal with the objective of examining the farming system, its major characteristics, and other aspects that affect the chosen enterprise model and its elements. Using the multi-stage purposive random sampling method, 130 respondents were chosen from the high hill region of the river system in the Jumla district of Nepal. Different parameters were investigated using the binary logistic regression model, with the kind of farm enterprise (i.e. agronomy, horticultural or livestock) serving as the dependent variable. Findings revealed that three key enterprises—agronomy, livestock, and horticulture—were found to dominate the integrated or multi-enterprise farming system. The pattern of household involvement in each enterprise under study was essentially similar, with 90 percent of households adopting major cereal crops , about four-fifth of them adopting livestock in an integration system and about three fourth adopting the production of vegetables. About two-fifth of them were having fruit trees in the enterprise where almost all of the households were noncommercial in nature . This type of integrated or multi-enterprise farming system is the norm alike in Nepal and the Indian subcontinent. Likewise, it was also well revealed that age of the household head, years of education and years of residency in the same place, family size, dependency ratio, and the visit of the government extension worker were the important factors in farmers' decisions on horticulture enterprises among the various aspects under investigation. The family size was the only significant variable in decision of the farmers to adopt or pursue cereal crop based enterprises, that was also because almost all the farming household at least have some cereal produced for the household consumption. The age of the household head, gender, dependency ratio, and credit facility were significantly associated with the adoption of the livestock enterprise by the household while credit and gender having a negative and significant association with adoption decisions and other variables had a positive correlation. The role of different socioeconomic and personality variables in farmers decision to adopt the type of farm enterprise is thus needed to be considered and actions on these variables is needed for the development of agricultural in the rural areas with higher adoption of agricultural technology in any types of enterprises.

KEYWORDS: farming system, enterprise, agronomy, horticulture, livestock

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INTRODUCTION

The geophysical situation of the Nepal can be divided into three main regions; the plain Terai in the south, mid hills and the highlands in the north (Nyaupane and Chhetri, 2009). The population distribution in these regions is not consistent. According to the latest census of the country, 53.61% population resides in the Terai, 40.31% in the hills and 6.08% in the high mountains. (CBS, 2021). Agriculture occupies the largest share of the national gross domestic product (GDP) in Nepal. Even if its share of GDP decreased to 33.1% by 2014–15 and to 25% in 202, from 36.64% of GDP in 2005–06; it still represented the largest economic sector (Pradhanang et al., 2015; GoN, 2021). Although 65.6% of the total population still engages in agriculture, various problems exist in Nepalese agriculture. Smallholder farmers from a variety of social, cultural, and ethnic backgrounds continue to rely heavily on the cultivation of crops and trees, sometimes in conjunction with the keeping of animals (Syan et al., 2019). The prevalent integrated farming with the cereal, horticultural and livestock based dominancy in different regions of the country are to be considered for the agricultural development.
The five physiographic areas that have been recognized in Nepal are the Terai (60-330m, 14% of Nepal's land area), the Siwaliks (1000m, 13% area), the middle mountains (1001-2500m, 30% area), the high mountains (2501-3500m, 20% area), and the high Himalaya (> 3501m, 23% area) (Dijkshoorn & Huting, 2009). Karnali region with jumla being it's one of important district represents the high hill of the country. These areas grow a variety of cereals, although rice, wheat, and maize are the main staples or cash crops produced. Finger millet, barley, buckwheat are also widespread on hills and mountains, though to a much less level in the Terai. There are shortages of food in both the hills and the mountains (FAO, 2019; MoALD, 2021). The food insufficiency and measures to overcome this could be developed by the study the farming system, their components and interrelation.

Today's agriculture is dealing with issues like stagnant or decreased food production, increased malnutrition, decreased cultivable land, environmental pollution, decreased groundwater table, increased production costs, short farm incomes, employment, etc. (Prakash et al., 2017). The increasing human population of Nepal at the rate of 0.93 % per annum (CBS, 2021), signifies that the demand for food grains is also expected to increase in the similar way. The Nepalese economy is predominantly rural and agricultural, and the shrinkage of the cultivable land is a serious problem being faced and is also a serious challenge to the sustainable and profitable farming (Paudel, 2016). This reduction in farm area or landholdings without any alternative measures for expansion of income opportunity results in reduced farm income and may lead to agrarian distress (Prakash et al., 2017). The underdeveloped parts of the country are mainly represented by the rural farmers. Although a number of promising technologies on crop production have been recommended through Nepal Agriculture Research Council (NARC) and related agencies, very few of them have been adopted in commercial scale due to inappropriate promotional techniques or inappropriateness of the varieties or technology to a particular location or due to poor access to marketing opportunities (Dhital & Joshi, 2017). Improving farmers' access to new and promising crop production technologies has been recognized as a critical step for increasing agricultural productivity.

Farming systems are economic and agricultural concepts that describe a farm household's use of land for farming, which includes systems for crop and livestock production, non-agricultural economic activities of farm household members (both on and off-farm activities), the income generated, and the

structure, in addition to in terms of natural, social, economic, infrastructural, and institutional resources. (Bertaglia et al., 2007; Dixson et al., 2001; Iraizoz et al. 2007; Keating & McCown, 2001; Köbrich et al., 2003; Kostrowicki, 1977; Van de Steeg et al., 2010). It is a way of characterizing a farm's strategy, the ways in which the idea of multiple functioning of agriculture is realized through diversified farm activities, as well as the factors that influence these activities. (Gomez & Gonzalez, 2007; Keating & McCown, 2001; Van de Steeg et al., 2010).

Social and economic factors are the main reason to change the attitude and skill towards the adoption of a farming system components (Lwayo and Maritim, 2003). According to Alavalapati, Luckert, and Gill, (1995) adoption process is a mental process that is directly influenced by social and economic factors. The study of the interaction of socio-economic and biophysical dynamics helps small farmers for the decision-making process (Baffoe-Asare et al., 2013; Matata et al., 2010). Social and economic factor influences the adoption decision by a farmer (Obeng &Weber, 2014). Based on a common proposition outline by Owubah et al. (2001), the willingness of farmers to go with a farming component is largely influenced by its importance.

In farm technology adoption, intrinsic motivation plays a vital role (Prager and Posthumus, 2010; Chirkov et al., 2006). Also, the ability of farmers to achieve their future ambitions or goals can be limited by various factors, such as lack of capital, policies, and regulations, low investment returns, environment, danger, and uncertainty, etc. (Marra et al., 2003; Pannell et al., 2006). As it is entirely personal, farmers vary in their understanding of these constraints (Anderson et al., 1988). Under this context research was done with the objective to analyze rural farming systems of Nepal; specifically, focusing on the types of farming systems and the factors associated with the adoption of different types of dominant enterprise by the farmers of the high hill of Karnali river system.

MATERIALS AND METHODS

Study area

The study was carried out in the Jumla area of Nepal's high hills, along the Karnali or Ghangara river system. The Karnali or Ghaghara River rises on the Tibetan Plateau near Lake Mansarovar and flows through one of Nepal's least populated and rural regions before cutting through the Himalayas to the south. The 202 km Seti River meets the Karnali River in Doti District after draining the western portion of the watershed. The 264 km long Bheri is another tributary that originates in the western Dhaulagiri Himalaya and drains the eastern basin before joining the Karnali close to Kuineghat in Surkhet. Kawari and Tila Rivers are other tributaries of the Karnali river system. Jumla lies on the north side of the Chakhure-Mabu ridge with an elevation of 2332 m between 80^0.50'E to 82^0.32'E longitude and 28^0.58'N to 290.3^0'N latitude. (Acharya & Paudel, 2020).

Sampling procedure and data collection

A reconnaissance field survey was done to understand the features of study area. Among three major river systems within the country, Karnali river basin provide water to the entire western part of Nepal. Jumla district was thus purposely selected in which agriculture is subsistence type and comes under most remote and rural areas in Nepal. Respondent farmers were selected using multi stage purposive random sampling method (Taherdoost, 2016) representing all geophysical regions from the adjacent local bodies and adjacent communities to the Karnali River. In Jumla district there are two valleys i.e

Sinja and Jumla valley. A total of 130 sample households (HH) were selected, 65 HH from each valley. The sample households were selected in such a way that the communities lie adjacent to a major tributary of the Karnali river system i.e. Tila River. The households that were involved in farming activities from the selected rural municipalities were the study population. A typical Nepali farmer has some agronomical commodities-mainly cereal crops, vegetables, some fruit, large animals and some small animals too as the components of the farm (Acharya & Paudel, 2020).

Interview Schedules was prepared, pretested and finalized after the field observation in the study area; which was also one of the qualitative tool of data collection for the study. The respondents from the selected households were the primary source of information while the publication from government and non-government organization, research articles and the national census was the major source of secondary information.

Data analysis

The demographic data were analyzed using the descriptive statistical tools and interpreted with the quantitative attributes. Similarly, the relationship between several chosen factors and the type of dominating enterprise in the farming system was examined using a binary logit regression model. The decision to choose the type of enterprise was the dependent variable, and a variety of different variables, including demographic factors (sex, age, family type and size, etc.), socioeconomic and cultural factors (like education, occupation, landholding/farm size, livestock holding, etc.), and sources of agricultural information (personal localite, personal cosmopolite, mass media), were under study as the independent variables.

Let Yi, the farmer's binary reaction in the fundamental model, have one of two possible values: Y = 1 if the farming system's dominant enterprise is the one specified—agronomy, horticulture, or livestock—and Y = 0 if not involved in that enterprise. Assumed that X is a vector of explanatory variables (x1, x2,..... xn) that influence the producer's decision to adopt the dominant enterprise type, and β a vector of slope parameters linked to X that gauges the impact of X's change on that likelihood. Thus, the probability of the binary response can be defined as:

If $Y_i=1$; $P(Y_i = 1) = P_i$

$Y_i=0$; $P(Y_i = 0) = 1 - P_i$

Where $P_i = E(Y = \frac{1}{X})$ is the conditional mean of Y given values of X.

Now on the basis of Hosmer & Lemeshow (2000), the probability of enterprise adoption can be expressed as follows:

$$P(Y_i = 1) = P_i = \frac{1}{1+\exp^{-z}}$$

Where, $Z = \alpha + \Sigma \beta_i X_i + \varepsilon_i$

The logit transformation of the probability of enterprise adoption decision, P (Yi = 1) can be exemplified as (following Gujarati, 2003):

$$L_i = \ln\left[\frac{Pi}{1-Pi}\right] = Z_i = \alpha + \sum_{i=1}^{n} \beta_i X_i + \varepsilon_i$$

Where Y_i (type of enterprise) = Dichotomous dependent variable (i.e. 1 if the farmer has adopted the enterprise; and 0 if not)

X_i= vector of variables included in the logit model,

β_i = parameters to be estimated,
ε_i = error term of the model, exp (e) = base of natural logarithms, L_i= Logit and $P_i / (1- P_i)$ = Odd ratios. Thus the binary model used in the study is specified as:
$Y_i = f (x_1, x_2, ….. x_n)$

RESULTS

Demographic characteristics

Status of major demographic characteristics has been described in Table (1). Accordingly, the average age of the respondents was 47.79 years with a very low level of education that was just slightly above the primary level. Farmers had higher years of farming experience (Table 1). The average years of farming experience was 25.51 years; with the average years in household decision being 22.84 years and most of them were found to be born in the same location, with their permanent residency for five decades. The average family size was 6.35 with a dependency ratio of 0.77. The average number of economically active populations in the family was 3.93± 1.84. The average economically dependent population of age below 15 and above 60 was 1.98 and 0.43, respectively (Table 1).

Table 1. Demographic characteristics of participants' HH across the Jumla district, 2019

Characteristics	District mean	SE
Age (in Years)	47.79	1.08
Level of education (years of schooling)	6.55	0.449
Farming Experience (in years)	25.51	1.028
Experience in HH decision making (in years)	22.84	1.060
Residence in same location (in years)	49.76	1.708
Total family size	6.35	0.329
Dependency ratio	0.77	0.089
Family members under 15 years of age	1.98	0.085
Family members of age 15-59	3.93	0.161
Family members of age above 60	0.43	0.064
Share of off-farm income in the family	15.38	2.499
Food sufficiency (months in a year)	5.92	0.203

Farming was the major source of family income for majority of the participants' households in the region; whereas contribution of off-farm income was limited to only 15% of the annual total family income (Table 1).

Land holding

Table 2. Average landholding (in Kattha) and land use patterns by households in Jumla district, 2019

Farming Land Characteristics	Average	SE
Total land	9.40	0.511
Irrigated land	4.75	0.408
Rice area	4.59	0.306
Maize area	2.11	0.207
Wheat area	3.04	0.216

Note: SE, standard error of the mean

Status of average land holding size has been presented in Table (2). Accordingly, the average land holding size of the household was 9.4 kattha (1 kattha equivalent to 338.63 square meter) whereas the average irrigated land was nearly half of the total land (4.75 kattha) (Table 2). Major cereal crops

grown by the farmers were rice, maize and wheat covering an area of 4.59, 2.11 and 3.04 kattha on average by a household. The produced grain was only sufficient to meet the food requirements of family members for less than a year period. .

Extension services

Table 3. Status of extension services obtained by the participants' HH in Jumla district, 2019

Characteristics	**District mean**	**SE**
Number of Farm and Home Visit	0.58	0.130
Number of visits to extension worker	1.03	0.199

Note: Se, standard error of the mean

Findings of this research showed that on an average visit by the extension workers to the farming communities remained less than one per year whereas average number of visits by the farmers to the extension workers was limited to one in a year (Table 3).

Practices of farm enterprises

The dominance of the agronomy enterprise in the study districts, that are related to the cereal crops is clearly evident as revealed from the findings of this research. Almost all of the households are involved in producing any types of cereal crops in their own (Table 4).

Table 4. The pattern of farm enterprise of Households across the Jumla district, 2019

Farm Enterprise	Frequency (N=130)	Percentage
Agronomy enterprise	117	90.00
Horticulture vegetable	93	71.54
Horticulture fruit trees	61	46.92
Livestock	102	78.46

Though practiced for a single season in most of the area of the district, about nine-tenth of farmers were involved in agronomical enterprises (Table 4). Similarly, more than three fourth of the farmers were involved in livestock enterprise. Farmers involved in the horticultural enterprise (with both vegetable and fruit trees) were 71.54% among which only 46% had fruit trees in their own field (Table 4). Almost three months of the year being very low temperature and most land under the cover of snow, vegetable and cereal crop production was not practiced in those areas and the fruit trees and livestock enterprise were in priority. In rest of the farming lands, rice, maize and wheat were the major crops cultivated with some instances of *Chino* – an indigenous crop cultivation by the farmers. Beside seasonal vegetables, apple and walnut were the major fruit in the farmers' field. Cattle, buffaloes, horses, mules, sheep, poultry (especially indigenous breeds) were the major livestock species reared by the farmers.

Factors associated with the farm enterprises

Table: 5 Determinants of the type of farm enterprises in Jumla District, 2019

Variables	Horticulture			Agronomy			Livestock		
	dy/dx	Coeff	P-value	dy/dx	Coeff	P-value	dy/dx	Coeff	P-value
Age	-0.007*	-0.084	0.051	0.001	0.006	0.893	0.011**	0.088	0.012
Gender	0.047	0.601	0.431	-0.005	-0.067	0.935	-0.399***	-2.409	0.001
Ethnicity	0.027	0.308	0.292	-0.019	-0.254	0.457	-0.060	-0.505	0.110
Years of schooling	0.10*	0.122	0.076	-0.004	-0.056	0.471	-0.012	-0.102	0.181
Experience in farming	0.004	0.040	0.315	-0.004	0.0243	0.147	-0.004	-0.336	0.337
Residence in same location	0.005**	0.054	0.026	0.002	0.323	0.277			
Family size	0.035**	0.402	0.032	0.024*	-0.138	0.079	-0.020	-0.167	0.152
Dependency ratio	-0.064**	-0.738	0.035	-0.010		0.761	0.113*	0.947	0.060
Primary occupation	0.179	1.337	0.147				-0.083	-0.921	0.332
Govt. extension worker	0.159*	2.966	0.080				0.044	0.401	0.634
Visit to extension worker	-0.013	-0.142	0.883				-0.134	-0.980	0.141
Training	-0.003	-0.033	0.981				-0.044	-0.342	0.624
Credit	0.069	0.673	0.360				-0.136*	-1.672	0.063
Total land	0.005	0.062	0.366	-0.004	-0.053	0.396	-0.002	-0.014	0.781
Log-likelihood	-41.368			-36.641			-49.051		
Prob>chi^2	0.004			0.572			0.000		
Pseudo R^2	0.278			0.094			0.275		

Note: coeff.-coefficient; Govt.-Government; Prob-probability; chi^2-chi square test

Jumla, a district in high altitude is dominated by the subsistence farming with a practice of integrated type of farming agronomy, livestock and horticultural enterprises which was clearly characterized from the findings of this research. The study of different factors which play an important role in decision of adopting these enterprises was done using a logistic model, which was highly significant for the two major enterprises i.e. horticulture and livestock. The model eliminated few variables under study for the agronomy enterprise, to deal with higher correlation and also for almost all the farming households following the enterprise. Table (5) shows the determinants or the major factors involved on the farmer's decision of adoption of these enterprises.

Among different variables under study, age, years of schooling, years of residence in the same location, family size, dependency ratio, farm and home visit by the government extension worker were the significant factors in farmers' decision on horticultural enterprise (Table 5). Horticultural enterprise consisting the cash crops and fruit with higher economic importance was the major enterprise in the study regions which is also under the priority of government. Dependency ratio, and age were negatively significant while the remaining factors were positively significant in that enterprise

adoption (table 5). Findings showed that the increase in per unit year of schooling, residence in the same location, unit increase in the family size and visit by the extension worker in the farm and home significantly increase the chance the family involve in the horticultural enterprise (Table 5).

A different scenario was seen with the sample farmers having agronomy as one of the dominant enterprises. Family size was the only factor under study that could play a positively significant role in the decision of the farmers in adopting or to enter into the agronomical enterprises. Other factors had no such significant effect on the adoption decision of the enterprises, but the age of the farmer and the years of residency in the location were positively associated while gender, ethnicity, years of schooling or level of education, years of farming experience, and dependency ratio were negatively associated with agronomical crop farming (Table 5). Per unit increase in these variables could lead to an increase in the chance that the farmer will not be adopting the agronomy enterprises. However, a significant association was found between the age of the farmer, gender, dependency ratio, and credit facility in adoption of the livestock enterprise by the household; where credit and gender have negative and significant association with adoption decision (Table 5).

Analysis of the data clearly revealed that per unit increase in the age of the farmers reduce the probability of adoption of horticultural enterprises while increment in the status of same variable (increased age) increases the farmers to be involvement in agronomy and livestock enterprise (Table 5). Likewise, women farmers were found more involved in horticultural enterprises. This might be because of their involvement in vegetable production which in most cases is absent for households with males as the head. Ethnicity and primary occupation, farmer's visit to extension service, training and the total land holding had no role in adoption decision for all the types of enterprises run by the farmers. On the other hand, level of education, though had no significant association with the agronomy and livestock enterprise, but were found associated with adoption of horticulture enterprises (Table 5). Likewise, a farmer with more years of settlement in the same location was significantly associated with running horticultural enterprises. In a similar way, the size of the family was positively and significantly associated with adoption of horticulture and livestock enterprises by the farming households. A visit from the extension worker motivates the farmers for adopting the horticultural enterprises. Likewise a farmer benefitting from the credit facility was not supposed to be involved in livestock enterprise (Table 5).

DISCUSSION

People of Jumla largely practice livestock husbandry because of the availability of grasslands/rangelands and pastures in majority of locations. According to Acharya and Paudel (2020), Jumla is home to some of the most well-known crop species in the nation, including Jumli marshi (rice), apple, common bean, walnut, chino, and kaguno. A traditional cold-tolerant common rice variety called Jumli marshi (*Oryza sativa* var. *japonica*) is grown in Jumla at an elevation of between 2,400 m and 3,050 m. According to Shahi and Heu (1979), this type is renowned for being grown at the highest height in the world. Jumla has a higher percentage of rangelands than agricultural lands, where animal husbandry is a major source of income. In Jumla, a farm household owns 9.3 cattle heads on average (Acharya & Paudel, 2020). The temperate climate keeps the region always cold and the district receives the highest average rainfall in August. Sub-polar type of climate also prevails in some

parts of this district (DDC, 2001). These important features of jumla is peculiar in characterizing particular types of farming systems since long time immemorial.

Characteristics of the farming system

Jumla is a remote and backward district as compared to major cities and plain terai districts lying in the northwest part of Nepal. Because of its remoteness, education level is very low and most of the HH practice varied agricultural enterprises. The demographic setting of households in study area aligns as described by Ray et al (2012) and Hoque (1984) who had featured the district a typical Asian small scale farmer as, living in a six-person household based on family labor and under a variety of tenure arrangements, with average farm unit of 1.5 ha; mixed farming system mainly devoted to rice with one or two draft animals and a small flock of mixed poultry. Farmers in this district adopt agronomical, horticultural and livestock enterprises. According to Fresco and Westphal (1988), a farming system is a decision-making entity made up of the farm household, cropping, and animal systems. It converts land, capital (external inputs), and labor (including genetic resources and knowledge) into valuable goods that can be used for consumption or sale.

In Jumla district agronomical and livestock enterprises were prominent over horticulture enterprises which was in line with Ray et al. (2012) where the gross cropped area was maximum for cereals (57.79%), followed by vegetable (22.15%) and plantation (6.67%). The result was different from those reported by Ruddle (1991) who stated that crop cultivation is taken as the most important in Asian farming whereas less importance is given to livestock raising.

Farmers largely practice livestock enterprises because of the high availability of grasslands/rangelands, the government thus have also prioritized livestock enterprise as the most prominent enterprise for high hills of the country. According to Devendra (2012), lack of irrigation is a common problem faced by the farmers which compose of the total of 84% who are dependent in rainfed farming in the nation which is not different for the farmers in the district too. Fan and Hazell (2000) studied data from 65 Agro-ecological zones of Indian region where 42% of the rural poor lived in rainfed areas and 16% in irrigated areas. Perhaps this fact matches well in our case as well since rainfed farming is dominating practice in the hilly and mountain region of Nepal.

Indeed, years of residence in the same location and farming experience have shaped the given farming system in Jumla which is in line with the findings reported by Jha (2003); Behera & France (2016). According to those authors, the generations of farmers and their experiences have formed, created, and maintained the specialized agricultural systems in any regions.

Farmers in rural Nepal were not even getting a single visit by extension workers during a year as revealed from the findings of our study. Dhital (2017) also had reported such types of issues in Nepalese public sector agricultural extension. Costly but less impact of extension programs; insufficient interaction and contact between extension workers and farmers; insufficient personnel and technical qualifications of grassroots extension workers were noted problems in Nepalese extension services. According to Devendra (2012) and Devendra (2007) Asian agriculture is typified by a mix of different farm enterprises with a diverse integration of crops and animals in farm systems performed by small and poor farmers. The majority of HH in Jumla had low arable land and practiced multiple enterprises in the farming system; almost all the households with the cereal crop, more than two third

household with horticultural crops and livestock in their own farm. All these enterprises interrelated with each other on the energy flow. Farming systems in rural areas of India and the Indian subcontinent are subsistence type with crops and livestock mixed and livestock having multiple functions such as supporting agriculture, transportation, food, and manure (Kuchimanchi et al., 2022). Such subsistence farming system is still a prominent practice in high hills and mountain regions of Nepal. The concept of commercial agriculture has not reached in the rural areas with exceptions in some of the horticultural crops with higher value viz. walnut and apple in Jumla district. The prominent subsistence farming with integrated farms are thus needed due attention for

Determinants of farm enterprises

Jumla is rich in agro-biodiversity with some well-known horticultural crop species such as apple, walnut and common bean. Because of the diverse agro-ecological situations in this district, different fruit and spices crops have niche value. During the last 10 years, the area and production of vegetable crops and fruit have increased drastically with the intervention of the government (Thapa & Dhimal, 2017). However, adoption of recommended technology is by far different at the farming level. Multiple factors such as social, situational, institutional and personal characteristics of farmers affect the adoption of modern technologies (Dhital & Joshi, 2016). According to Mulugeta (2011) factors such as sex of house hold head, participation in training on farm production, management and other extension programs, access to inputs like seed, credit and membership of groups managed for extension activities significantly affect the adoption of beans in horticulture enterprises. In contrast, training and visit to extension workers had negative impact in Nepalese agriculture as trained manpower tend to move to urban areas. Findings of a study by Mwase et al (2015) revealed that major factors affecting adoption of a farm enterprise in South Africa were age of farmers, initial costs, extension knowledge, availability of agroforestry germplasm, and government policies. Similarly, Jara-Rojas et al (2020) also reported that the availability and utilization of financing, geographic location, and the existing livestock system all had an impact on the decision to embrace agroforestry practices. Similarly the land holding size, size of the family, level of education, were the important factors influencing farmers to adopt tree planting on their farm (Khalwale et al., 2018). Similar to this, in the mid-hills of western Nepal, households with a male household head were more likely to take on an agricultural venture when they had a larger household size, more land and cattle, higher cash income, support for integrating crops, and were located further away from the community forest (Khatri et al., 2023).

According to Ullah et al. (2018), the adoption of new technologies by farmers is influenced favorably by their age, education, household size, membership, use of a cell phone, farm size, access to extension services, and involvement in non-governmental organizations. Input pricing, availability to credit, ownership of animals and machinery, off-farm income, and farmer experience all have a positive and significant impact. Similarly, Kassa (2015) reported factors such as nearness to the main road, farming experience, labor, land size and income that could significantly affect the practice of fruit tree based farming system in small farmers in Ethiopia. Lack of sufficient extension visits to the farmers is the situation in the district which would further motivate the farmers to adopt the enterprise as similar with its positive influence in technology adoption as reported by Matata et al (2010); Mulugeta (2011); Asante et al (2018) that could rendered positively in developing the attitude favorable to technology adoption. Ainembabazi and Mugisha (2014) also concluded that farming experience influence the early stages of adoption of agricultural technology for some crops, when farmers are still testing its potential

benefits. the study also shows that the experience in farming had positive effect on adoption of horticultural enterprises; the more experienced farmer tend to move towards horticultural crops for being higher value and more economic importance.

Mume et al. (2023) also found that the households with a larger dependency ratio were less likely to acquire agricultural technology similar to the findings in Jumla. i.e. it had a significant but unfavorable impact on the adoption of new technology. Age of the farmers and their positive association with the adoption decision of agronomical crops was also reported by Mgomezulu et. al. (2023) while it was the case of contrary as reported by Onyeneke (2017). The level of education plays an important role and have positive relation with adoption decision of farm enterprise as reported by Mgomezulu et al. (2023), Bezu et al. (2014); Ghimire et al. (2012) while it was found to have negative influence in the study by Bago et al. (2018). The more educated farmers here in jumla tend to move to horticulture enterprise which was opposite for livestock and agronomical enterprises, which might be because of the higher cash and economic value of the potential horticultural crops ion the district and less economic returns from agronomical and livestock enterprise.

CONCLUSION

The prevalent rainfed based integrated farming system; by farmers with long time residency and dominance of well integration with cereals and livestock; low practice of horticultural enterprises; is the characteristic feature of Nepalese agriculture especially in the rural context. The adoption decision of each enterprise farmers adopt in their farming system is the outcome of various socioeconomic, personal and psychological factors of the farmers. The extension efforts thus needs to be focused with due emphasis on each socioeconomic and personal dimensions and hence the cumulative efforts can lead to higher productive farming system and agricultural development.

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