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ADOPTION OF LIVESTOCK AS A COMPONENT IN THE FARMING SYSTEM OF MID HILLS IN NEPAL

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ABSTRACT

The goal of this study conducted in 2019 was to thoroughly look into the local farming methods, population demographics, and physical features in the Panchadewal-Binayak Municipality and Turmakhand Rural Municipality of the Achham district in Nepal through a field survey. Using a multi-stage purposive random sampling strategy, 130 sample households representing agricultural communities were chosen, with an emphasis on the different geophysical zones next to the Karnali River. Achham, a least developed region in Nepal's far-western mid-hills, was the study's main focus. The study looked at a number of socioeconomic variables to see how they related to farmers' adoption of livestock enterprises. Descriptive statistics were used to evaluate and interpret the demographic data utilizing quantitative features. Similarly, a binary logit regression model was used to investigate the association between a number of selected characteristics and the choice to adopt animals in the farming system. Findings showed that the adoption of livestock was negatively impacted by the head of the household's gender, ethnicity, size of family, and farmers' interaction with extension agents. On the other hand, the major occupation of the head of the household and availability of financial facilities or credit were found to be associated with a greater likelihood of adopting livestock. The study highlights the significance of addressing these critical drivers in technology distribution and supporting extension initiatives for increased farmer engagement in the livestock enterprise, acknowledging livestock as a vital component of the farming system.

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INTRODUCTION

Nepal has been divided into three main regions: the flat Terai region to the south, the mid-hills, and the rising highlands to the north. These regions have an uneven population distribution, with 53.61% of the population residing in the Terai, 40.31% in the hills, and 6.08% in the high mountains (CBS, 2021). Although GDP was dropped from 36.64% in 2005–06 to 33.1% in 2014–15 and 25% in 2020, the agriculture sector is still the main driver of the Nepalese economy (Pradhanang et al., 2015; GoN, 2021). An introduction to Nepalese rural society can be found in the fact that 65.6% of the population is still employed in agriculture. For Nepalese farmers, who are mostly small-scale landowners from a range of social, cultural, and ethnic backgrounds, raising animals is a significant activity (Syan et al., 2019).

The feasibility and profitability of farming are seriously threatened by Nepal's predominantly rural and agrarian

economy and the nation's diminishing arable land (Paudel, 2016). The degree of adoption of various farm technologies and firms is hampered by insufficient marketing strategies, technology that are inappropriate for particular regions, or a lack of access to marketing possibilities (Dhital & Joshi, 2016). Improving farmers' access to new interventions in the farm is thought to be essential for raising agricultural output. Social and economic factors have a major impact on farmers' willingness to adopt any agricultural technologies and practices (Lwayo & Maritim, 2003; Alavalapati et al., 1995). Small farmers benefit greatly from the complex interaction between socio-economic and biophysical dynamics, which helps them make decisions (Baffoe-Asare et al., 2013; Matata et al., 2010; Obeng & Weber, 2014). The perceived significance of an agricultural component is a significant factor in determining farmers' desire to embrace it, in addition to socioeconomic and personal factors (Owubah et al., 2001).

The goal of this study was to examine Nepal's rural agricultural systems, with a focus on farming practices and the different variables influencing farmers' adoption of livestock in the mid-hill region of the Karnali River system. Further it was learned more about the intricate linkages that exist between social, economic, and personal aspects as well as how important it is to farmers to integrate animal husbandry methods into their agricultural endeavors. The specific objective of the research is to offer insightful information about determinants of farmer decision regarding the inclusion of livestock in their farming system.

MATERIALS AND METHODS

Study area

The study was carried out in Achham, a district in Nepal's far-western mid-hills that is renowned for being one of the least developed areas. The Karnali River system, which rises on the Tibetan Plateau close to Lake Mansarovar and flows through some of Nepal's remote and rural regions, runs through this district. Achham borders the Nepalese provinces of Karnali and Sudurpaschim and shares the western bank of the Karnali River (Khatiwada et al., 2016); covering 1692 square kilometres, and situated between latitudes 28°46'N and 29°23'N and longitudes 81°32'E and 81°35'E. The terrain of the district is classified as mid-hill for around 90% of its total area, and high-hill terrain makes up the remaining 10% (UNRCHCO, 2013). Achham is classified as a backward area by the Nepalese government because of its distant location; underdevelopment in infrastructure, and backwardness in context of social welfare services. The local economy is mostly based on agriculture, and seasonal migration of people to India is a major factor (Bhatt, 2015). The district is a fascinating and significant site for studying agricultural techniques and socioeconomic dynamics because of its distinct geographic and socioeconomic dynamics.

Sampling procedure and data collection

A preliminary field survey was carried out to obtain an extensive understanding of the research area, its population, and the predominant farming practices. The study's site was the Panchadewal-Binayak Municipality and Turmakhand is a Rural Municipality in the Achham district because of its proximity to the Karnali River and the presence of a mid-hill roadway that passes nearby it. For the study, a total of 130 sample houses representing agricultural households in the municipality were chosen. A purposive multi-stage random sampling procedure was used to choose the farmers who would be respondent participants. To provide a representative and diverse sample, this strategy attempted to incorporate a variety of geophysical regions that are adjacent to the Karnali River.

Typical Nepali farmers manage holdings that include agronomical crops, horticultural fruits, vegetables, big and small animals, and some agroforestry components in the studied population. Together, these elements create the complex structure of the farm, which reflects the variety of agricultural pursuits prevalent in the area. The pre-tested interview schedules were carefully set up, thoroughly examined, and improved in light of field observations made in the study region.

Data analysis

Descriptive statistics were used to evaluate and interpret the demographic data utilizing quantitative features using ms-excel and stata-v14. Similarly, a binary logit regression model was used to investigate the association between a number of selected characteristics and the choice to adopt animals in the farming system. The choice of livestock was the dependent variable; the independent variables included a wide range of variables, such as sources of agricultural information

(personal localite, personal cosmopolite, mass media), socioeconomic and cultural factors (like education, occupation, landholding/farm size, livestock holding, etc.), and demographic factors (like sex, age, family type and size, etc.). Let Yi, the farmer's binary reaction in the fundamental model, have one of two possible values: Y = 1 if the farming had livestock in the farm and Y = 0 if not involved in that enterprise. Assumed that X is a vector of explanatory variables (x_1, x_2,..... x_n) that influence the producer's decision to adopt the livestock, 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 based on Hosmer & Lemeshow (2000), the probability of livestock 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 livestock adoption decision, P (Yi = 1) can be exemplified as (following Gujarati, 2003):

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

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.

Table 1. Variables under study for the econometric analysis.

Variables	Description and values	Expected sign
Age	Age of the HH Head in years	+/-
Gender	Gender of the HH Head; 1= male; 0 otherwise	+/-
Ethnicity	1 for Brahmin/Chhetri; 0 for others	+/-
Education	Years of formal education	+
Experience in farming	Years of experience in Farming	+
Family size	Number of People	+
Dependency ratio	The ratio of dependent population to economically productive population	+/-
Primary occupation	1 for Agriculture; 0 for Others	+
Visit by Govt. extension worker	Number of Farm and Home Visit by Government Extension Workers in a year	+
Visit to extension worker	Number of visits to extension office/worker by the farmer in a year	+
Training	1 for training received; 0 for Untrained farmers	+/-
Credit	1 for farmers with credit facilities and 0 for farmers without credit	+/-
Total land	Area of Land Owned and farmed (in Kattha)	+/-

RESULTS AND DISCUSSION

Table 2 revealed that the average age of the respondents was 49.97 years, and they only had a basic education. They had been farmers for an average of 27.66 years, of which 24.62 years were spent making household decisions. The majority of responders had lived in their current location permanently for more than 42 years after being born there. The average family size was 7.23, and the dependency ratio was 0.83.

Factors associated with the livestock enterprise

Given its challenging geography, complex socioeconomic frameworks, and deeply ingrained traditional institutions rooted in religion, culture, and customs, the Far Western province of Nepal has developmental obstacles.

The Government of Nepal has classified nine districts in the far west province as backward areas, including Accham (UNRCHCO, 2013). Achham is a mid-hill district

that specializes in subsistence-oriented integrated farming that includes horticulture, livestock, and agronomy businesses. The district's main source of income is agriculture, although both the average amount of agricultural land holdings and the proportion of farming households with land are declining. Achham is classified as a district with a severe food shortage, which prompts many people who are food insecure to migrate seasonally to India in search of employment possibilities as a common coping mechanism (UNFCO, 2018).

Table 2. Demographic characteristics of households in Achham district, 2019.

Characteristics	District mean	SE
Age	49.97	1.153
Years of schooling	5.11	0.457
Farming Experience (yr)	27.66	0.000
Experience in HH decision-making (yr)	24.62	1.162
Years of residence in the same location (yr)	42.43	1.174
Total Family size	7.23	1.529
Dependency ratio	0.83	0.271

Table 3. Determinants of the livestock in the farm enterprises in Achham District, 2019.

Variables	dy/dx	Coeff	P-value
Age	-0.002	-0.035	0.256
Gender	-0.135*	-1.482	0.074
Ethnicity	-0.056**	-0.824	0.042
Education	-0.005	-0.078	0.341
Experience in farming	-0.001	0.020	0.500
Family size	-0.017**	-0.250	0.036
Dependency ratio	-0.028	-0.411	0.467
Primary occupation	0.193**	1.708	0.022
Visit by Govt. extension worker	0.042	0.652	0.436
Visit to extension worker	-0.227**	-1.962	0.039
Training	0.086	1.793	0.106
Credit	0.157**	1.930	0.029
Total land	-0.001	-0.010	0.829
Log-likelihood		-39.915	
Prob>chi^2		0.001	
Pseudo R^2		0.302	

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

In rural farming systems, livestock is an important enterprise that makes a substantial contribution to the sustainability of agriculture. The study explored the elements that lead to the acceptance of livestock as a significant business, emphasizing the importance of the livestock with the help of a binary logit model. Table 3 sheds light on the key variables and criteria influencing farmers' choices to adopt these businesses. With log-likelihood (-39.915) and overall statistical significance (prob>chi^2), the model used to carry out the study on various factors and their effects on the farmers' acceptance of the livestock enterprise in the farming system in the Achham district appeared to match the observed data fairly well. The findings demonstrated a significant correlation between the independent variables and the total dependent variable (Table 3). According to the pseudo-R^2, the model also explains roughly 30.2% of the variation in the dependent variable, demonstrating a respectable degree of explanatory power.

Among the various socioeconomic factors studied for their associations with the adoption of the livestock

enterprise, it was found that the gender of the household head, ethnicity, size of the family, primary occupation of the household head, farmers' visits to the extension worker for extension services, and access to credit facilities were statistically and significantly associated ($p<0.05$). These elements may therefore be regarded as influencing the kind of farming business in the Achham district. Other factors that were not found to be significant predictors of the farmers' decision to start a livestock enterprise included the age of the household head, year of education, years of farming experience, dependency ratio, farm and home visits by government extension workers, training the farmer received, and the total amount of land owned by the farmers.

The adoption of livestock in the farming system is negatively associated with a number of criteria, including gender (with the male head of the home), ethnicity, family size, and the necessity of using extension services rather than having them available on the farm. Farmers' adoption of livestock in Achham was found to be significantly predicted by the gender and ethnicity of the HH head. Adopting livestock is less likely by roughly 13.50% if the head of the home is a man, and by 56% if the household is made up of Janajati or Dalit people. In a rural household, the gender of the head of the household is a significant factor in decision-making. When there is a male head of the household, they typically like to engage in outdoor activities in addition to farming. Males in Achham would rather travel to India for seasonal work, which entails spending less time in homes and farms. Thus, the negative correlation between gender and livestock enterprise indicates that households headed by women tend to adopt animals, meaning they live primarily on their own farms. The gender-adoption decision association also supported similar findings, since women are more likely than men to rear livestock (Quisumbing et al., 2015; Johnson, Kovarik, Meinzen-Dick, Njuki, & Quisumbing, 2016). The tendency of women to raise animals can be ascribed to a confluence of home, cultural, and economic causes. Cultural conventions frequently assign women to work in agriculture, and managing livestock has historically been a feminine responsibility. Household assets, or livestock, are essential to women's responsibilities and correspond with their roles in household chores. Furthermore, women are well-suited to small-scale livestock operations since they are accessible and need fewer resources and physical labor, particularly in environments with limited resources. Raising livestock provides a diverse source of income, empowering women in the workforce and enhancing the financial security of households (Fabiyi & Akande, 2015; Roy, Haque, Jannat, Ali, & Khan, 2017; Sultana, Hossain, & Islam, 2015). The custom of transferring expertise in animal husbandry puts women in a stronger position to manage cattle. Keeping livestock promotes women's independence and gives them access to markets, enabling them to actively participate in both the home and the economy. Promoting sustainable agriculture and empowering women require acknowledging and valuing the contributions that women make to the rearing of livestock.

The Brahmin and Thakuri communities predominate in Achham's rural areas. Due to their greater access to education and other possibilities, members in this social stratum are more likely to engage in activities outside of agriculture. These individuals are therefore less inclined to engage in livestock ventures, which forces them to spend the majority of the year on their farm. When an invention can be accessed with less effort, farmers are more likely to adopt it (Norton & Alwang, 2020; Kernecker et al., 2020; Kuehne et al., 2017). The number of family members or the size of the family is also negatively connected with the adoption of a cattle operation. According to the results, for every additional household member, the likelihood of owning a cattle operation decreased by roughly 1.70%. Comparably, problems with resource allocation, conflicting demands, space limitations, economic pressures, labor intensity, complexity of decision-making, and risk management considerations are the basis of the negative correlation between household size and livestock enterprises (Mwangi & Kariuki, 2015; Chagwiza, Muradian, & Ruben, 2016). All of these things work together to make larger households less likely to acquire or grow livestock enterprises. Larger households find it challenging to allocate resources such as time, labor, and money among multiple obligations, which limits their ability to give livestock management top priority and investment. The diverse needs of a larger family can impede the dedicated care required for effective livestock rearing. Spatial limitations may restrict the availability of land for grazing or infrastructure development. Economic pressures, with stretched financial resources, often reduce funds for essential aspects of livestock care. Additionally, the labor-intensive nature of livestock

management can be daunting in larger households where family members have diverse responsibilities. Decision-making complexity and risk aversion further contribute to a reduced likelihood of adopting or expanding livestock enterprises in larger households, highlighting the intricate dynamics between household size and successful livestock ventures. Similarly, more household's members increase the need for food and income. In a district like Achham, where the opportunities for economic activity are less, they have to go for seasonal labour to India or maybe within the country. But for the family with a smaller number of members they prefer staying to their own place and ultimately creating a positive thrust for adoption of livestock enterprises.

The likelihood of a farmer's household owning a livestock enterprise is 19.3% higher if farming was the principal occupation of the household head. It might be because farmers who earn their living primarily from sources other than agriculture opt not to invest in livestock enterprises. Similar arguments that the adoption of livestock is influenced by various factors was also given by Paudel Khatiwada et al. (2017); Dessart, Barreiro-Hurlé, & Van Bavel (2019); Joshi, Kalauni, & Bhattarai (2018); Neupane, Paudel, Adhikari, & He (2022) with occupation and access to credit being key determinants. The occupation of the farming household often dictates the feasibility and practicality of integrating livestock into their farming activities. Those with primary occupation being agriculture; are more likely to adopt and benefit from livestock enterprises similar with the findings of Gil, Siebold, & Berger (2015); Cortner et al. (2019); Agus & Widi (2018). When agriculture serves as the farmer's primary occupation, it allows for substantial time investment in household activities, particularly in attending to the needs of livestock. Unlike crops that may endure short periods without attention, livestock demand consistent care and cannot be left unattended. Farmers engaged primarily in agriculture are more likely to be present on the farm, ensuring continuous supervision of their livestock. This dedicated presence is essential because livestock care is a daily, labor-intensive responsibility that cannot be neglected. Having agriculture as the primary occupation enables farmers to manage their time effectively, ensuring the well-being and productivity of the livestock. This highlights the integral relationship between the nature of a farmer's primary occupation and their ability to meet the demands of livestock management (Herrero et al., 2013; Berckmans, 2014). When farmers lack alternate or additional professional engagements, their inclination toward adopting livestock increases. Livestock, particularly in the case of goats and chickens, demands more investment but also offers significant benefits (Udo et al., 2011; Upton, 2004). Regular expenses for feed, medicines, and other necessities make a ready source of liquid assets crucial for successful livestock enterprises. Farmers without other professions are better positioned to dedicate time and resources to meet these demands, making livestock enterprise adoption more feasible.

The household was discovered to be engaged in livestock rearing in Achham when they had access to credit or loans for agricultural purposes; people were more likely to adopt an enterprise when they had access to credit or loans. The likelihood of owning a livestock enterprise increases with financial availability. Moreover, the relationship between access to credit facilities and livestock adoption is pivotal. The availability of credit facilities significantly impacts the adoption of livestock. Access to credit enables farmers to invest in the purchase, care, and management of livestock and facilitates the necessary financial support for livestock-related expenses, enabling farmers to establish and sustain their enterprises effectively (Njogu, Olweny, & Njeru, 2018; Gwiriri, Bennett, Mapiye, & Burbi, 2019); Gil et al., 2015). Financial support enhances the capacity of farming households to establish and maintain sustainable livestock enterprises, contributing to diversified and resilient farming systems. Overall, the intersection of occupation and credit availability shapes the adoption landscape of livestock within rural farming communities. The access to credit not only promotes the adoption of livestock but also contributes to improving farmers' overall economic standing. It underscores the vital role of financial resources in enhancing agricultural practices and elevating the standards of farmers engaged in livestock enterprises. In the other hand; when the farmers get the extension and advisory services in their own farm or surrounding, they may go for adoption of the livestock enterprises. In contrary have negative association if needs to visit to extension services. Thus, increasing extension service to their door step by increasing the farm and home visit motivates the farmers for adoption of livestock enterprises. When there were extension

facilities involved, the model predicts either an adverse or no correlation between the extension visit and farmers' adoption of livestock. Although not statistically significant, it was found that the farm and home visits by the government extension worker were positively associated with a rise in the likelihood of owning animals. However, when farmers needed to visit or visited an extension agent for support or guidance on farming that had a negative and severe impact on the business. The likelihood of having a livestock enterprise in the enterprise significantly decreased for farmers who had to see the extension worker for advisory services. The study further showed a few more variables that did not significantly affect the adoption of livestock. The age of the home head has a favorable but insignificant association with the farming system's livestock activity; the likelihood that a farmer will have cattle decreases by about 3.5% for every year of age. The relationship between years of education and the adoption of livestock was similarly unfavorable but not statistically significant. The probability of having cattle fall by about 7.8% for each additional unit of the farmer's total number of years of education. Additionally, it was seen that the household's dependency ratio and overall amount of land ownership had a poor and insignificant relationship to the livestock enterprise. The probability of owning livestock reduced by about 1% for every additional unit of land possessed. On the other hand, the adoption of a livestock venture by the farmer in the farming system was positively but insignificantly correlated with the years of farming experience and training of the farmer. The table showed that the likelihood of owning livestock rises by about 2% for every extra year of farming experience, and that receiving training increased the likelihood of owning animals for the farmers.

CONCLUSION

The integrated and subsistence type of farming is prominent in the rural parts of Nepal, thus extension efforts should focus on the efforts for sustainable agriculture. The factors associated with the farmers' decision are the key areas to be stressed for the technology dissemination and also for promotion of the extension efforts for higher expansion of farmers' involvement in the livestock enterprise. Gender, ethnicity, size of the family, primary occupation, number of farmers visit to extension service and facilities of credit services are the key to livestock enterprise and animal husbandry promotion and thus tailoring of extension programs should be based on these factors in program and plan formulation.

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