Willingness to Pay for Cattle Insurance in Nepal: A Double-Hurdle Model Perspective

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ABSTRACT

Since the introduction of the Crop and Livestock Insurance Directives in 2013, livestock insurance has gained popularity in Nepal. Despite this, adoption rates over the past eight years have been low, even with substantial government premium subsidies of up to 80%. This study employs a double-hurdle model for quantitative analysis, focusing on the determinants of cattle farmers' willingness to insure their farms, as well as the insurance premiums they are willing to pay (WTP). The research identifies significant factors that influence the decision to adopt insurance. Positive impacts arise from the farmer's age, education, history of livestock loss, awareness of insurance, dairy farm income, number of cattle, and access to loans. Conversely, factors such as male gender, cattle rearing experience, and larger household sizes negatively affect the willingness to insure. In terms of premium determination, age, household size, livestock loss history, off-farm income, number of cattle, and loan accessibility all have a positive effect. However, breed type, marital status, and revenue from dairy farms are negatively associated with premium levels. The annual WTP for cattle insurance among dairy farmers was observed to range from $48 to $71 (NRs. 6315-9341), with an average of $58 (NRs. 7631). Interestingly, the majority of farmers show their commitment to risk management by being willing to accept premiums equal to 5% of the value of their cattle. This research contributes to the understanding of livestock insurance premiums in developing countries, specifically in Nepal. While noting a gap in awareness among dairy farmers regarding government subsidy programs, it also highlights the potential for extending insurance programs.

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1. Introduction

Insurance plays an important role in mitigating the financial impact of risks in the agricultural sector, particularly within the dairy industry. Cattle and buffalo are the primary contributors to milk production, with their respective shares being 35% and 65% (FAO, 2018). In Nepal, where the dairy sector constitutes a significant segment, approximately 63%, of the livestock sector's share of the gross domestic product (Banskota et al., 2020), the vulnerability to various risks highlights the need for effective risk management strategies. This paper explores the factors affecting dairy farmers' willingness to insure and willingness to pay (WTP) for insurance premiums.

Despite contributing markedly to Nepal's GDP, the dairy industry is frequently subjected to numerous risks including, but not limited to, disease, climatic changes, and market fluctuations, which can severely impede farmers' income stability (Koirala and Bhandari, 2018; Lahnamäki-Kivelä, 2022). To mitigate such risks and protect against economic losses, the government of Nepal introduced the "Crop and Livestock Subsidy Premium Insurance Directive 2013" offering a premium subsidy of 80% with a 5% contribution from farmers (Investopaper, 2021). But the overall penetration remains low at 1.10% (Koirala & Bhandari, 2018). The minimal uptake of agricultural insurance in Nepal, particularly for cattle, indicates an insufficiency in risk mitigation strategies among farmers (Koirala & Bhandari, 2018). This issue of limited coverage also emerged among citrus growers in the Sindhuli district (Dahal et al., 2021). Determinants such as farm size, training, and socio-economic conditions influence willingness to pay (Abugri et al., 2017; Danso-Abbeam et al., 2014).

Studies regarding willingness to pay (WTP) for dairy/cattle insurance in Nepal are limited, with even less focus on how market volatilities and production uncertainties affect this WTP. Despite government subsidies, insurance uptake remains low. While livestock insurance is mandatory for agricultural loan recipients in Nepal (Ghimire et al., 2016), the literature

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lacks a detailed analysis of farmers' premium payment capabilities (e.g., Adhikari and Bidari, 2018; Chizari et al., 2003; Devkota et al., 2021; Hosseini and Zadeh, 2011). However, this research was intended to assess factors influencing dairy farmers' willingness to insure and willingness to pay (premium) for insurance. This might be helpful for the policymakers and insurance providers while making national insurance policies, subsidy plans for insurance premiums, and livestock development strategies that would ultimately benefit the dairy farmers at the district level. The objectives are to determine the willingness to pay (WTP) for insurance among dairy farmers in Dang district, focusing on identifying their risk management practices, investigating their willingness to insure dairy animals, and evaluating the socio-economic factors influencing their WTP for livestock insurance.

1.1. Conceptual Framework

We have developed a conceptual model to examine the demographic and socioeconomic factors that influence farmers' decisions and their attitudes toward the adoption of, and willingness to pay (WTP) for, cattle insurance. The adoption of any intervention is multifaceted, depending on various factors. As depicted in Figure 1, the conceptual framework outlines the determinants that affect WTP for cattle insurance within the specific socio-economic context of Nepal. Most WTP studies that deal with livestock insurance and the factors that affect the decision process have been carried out for developed countries, while studies focused on developing countries are scarce. This is particularly true for Nepal. Addressing this gap, we tested several additional factors that may have an influence on WTP for cattle insurance in the context of urban Nepal.

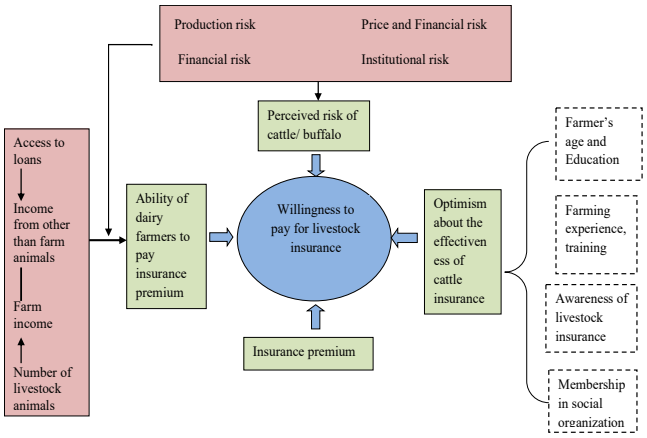

Figure 1. Conceptual framework of WTP for livestock insurance

2. Materials and Methods

2.1. Data Collection Methods

The study was conducted under the Prime Minister Agriculture Modernization Project (PMAMP) of Nepal. Dang, the second-largest valley in Asia (Khan, 2020), was chosen for its favorable climatic conditions and substantial potential for dairy farming productivity. The research selected three key study areas—Ghorahi, Tulsipur, and Lamahi—following consultations with district agricultural officials (Figure 2). We used primary sources for data collection. Primary data collection involved a reconnaissance survey to understand the study area, a questionnaire survey with face-to-face interviews, focus group discussions with dairy farmers, and field observations. During the reconnaissance survey, we gathered basic information about the research area, including demographics, dairy cooperatives, and insurance companies through informal meetings with key stakeholders. We also, as a part of a questionnaire survey, conducted interviews with dairy farmers using structured and semi-structured questionnaires, exploring quantitative and qualitative aspects of their views on cattle insurance. Focus Group Discussion (FGD) involved engaging groups of dairy farmers with similar backgrounds in discussions to delve deeper into cattle insurance issues and validate interview data. Frequent visits to farms and cooperatives allowed us to observe the current state of dairy farming in the study area.

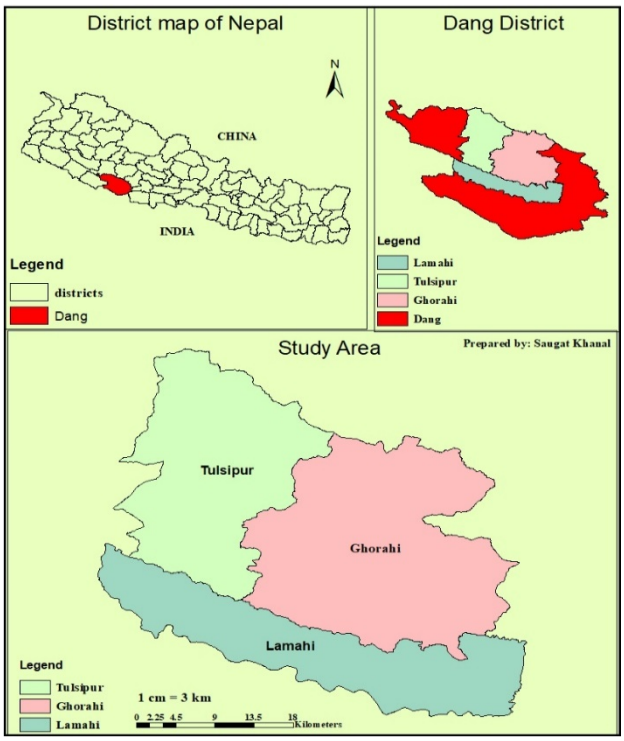

Figure 2. Map of Nepal showing the study area

2.2. Sampling Technique

Our sampling method began with a pilot survey involving ten dairy farmers to refine our questionnaire. Subsequent data collection was executed through a combination of purposive and random sampling, resulting in face-to-face interviews with 150 primary farm operators and decision-makers. The sample size was determined with the help of the following formula given by Cochran (1963), which yielded a sample size of 150.

$$n=\frac{N}{1+Ne^2} \quad \text{……..(1)}$$

where n= sample size, N= Population size, e= margin of error (In this study, we will use e=0.05 i.e., 95% level of confidence)

2.3. Data Analysis and Empirical Model

This study aligns with the utility maximization theory, referencing the model by Okoffo et al. (2016) for evaluating WTP among cocoa farmers.

In this model, a dairy farmer's adoption of livestock insurance is hypothesized as a function of utility maximization, beyond mere benefit optimization (McConnell et al., 2009). The farmer's decision is posited to align with the utility level that best matches his preferences within his budgetary constraints, as per random utility theory (Lubungu et al., 2012). The farmer's utility from choosing a given insurance option is denoted by *Uij*, and the choice is made based on the utility derived relative to other options. The probability of selecting an option is thus a function of the comparative utilities and can be expressed as:

$$P\ (yi = j) = p(Uij \geq Uik\ |X, \phi k = j) = P(\varepsilon tk - \varepsilon ij \leq X'ij\beta j - X'ij\beta k|X, \phi k \neq j) \quad \ldots\ldots\ldots\ldots (2)$$

where y_i represents the chosen option, X is a set of variables reflecting the farmer's personal, farm, and institutional characteristics, β represents the parameters to be estimated, and ε represents the error term. The utility differential, unobserved, is:

$$Vi = Uij - Uik \quad \ldots\ldots\ldots\ldots (3)$$

The choice is then modeled as a binary outcome based on whether this differential is positive, indicating the adoption of insurance if it enhances the farmer's utility.

$$Ji \in j = \{1 \text{ if } V > 0,\ 0 \text{ otherwise}\} \quad \ldots\ldots\ldots\ldots (4)$$

Double-Hurdle model

The Double-Hurdle model assumes that a farmer's decision regarding insurance occurs in two phases. Initially, the farmer decides whether to buy insurance, influenced by diverse economic, socio-cultural, and demographic factors. Subsequently, if insurance is considered, the decision on how much premium to pay is made—this choice depends on the utility the farmer expects from the insurance. This modeling approach aligns with Okoffo et al. (2016).

In the first hurdle, willingness to adopt insurance is assessed through a probit regression, where WTI assumes a value of 1 if positive, and 0 otherwise, with WTI modeled as

$$WTI = 1 \text{ if } WTI > 0 \text{ and } WTI = 0 \text{ if } WTI \leq 0 \quad \ldots\ldots\ldots\ldots (5)$$

$$WTI = z_i'\alpha + \varepsilon_i \quad \ldots\ldots\ldots\ldots (6)$$

where z is a vector of the farmer, farm, and institutional characteristics, α is a vector of parameters and ε_i is the error term.

The empirical model for dairy farmer's willingness to adopt livestock insurance is specified for this study as;

$$WTI = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \ldots\ldots\ldots\ldots + \beta_{17} X_{17} + \varepsilon_i \quad \ldots\ldots\ldots\ldots (7)$$

WTI is the probability that an i_{th} dairy farmer is willing to adopt livestock insurance. βi is the coefficient of the explanatory variables and ε_i is the error term.

The second hurdle evaluates the premium payment willingness through a truncated regression, with positive responses modeled by:

$$WTPamt_i = WTPamt^*_i \text{ if } WTPamt^*_i > 0 \text{ and } WTPamt^*_i = 0$$

$$\text{if otherwise } WTPamt^* = \chi'_i\beta + u_i \quad \ldots\ldots\ldots\ldots (8)$$

Where WTPamt* is the observed response on how much dairy farmers are willing to pay for crop insurance. χ represents the explanatory variables, β is a vector of parameters, and u_i is the error term that is randomly distributed. Here, WTP_{amti} reflects the amount a farmer is prepared to pay, informed by the relevant parameters and error terms.

The empirical model of the truncated regression model (Tobit model) is specified for this study as;

$$WTPamt_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \varepsilon_i \quad \ldots\ldots\ldots\ldots (9)$$

where WTP amt_i is the amount, an i^{th} dairy farmer is willing to pay, β_i are parameters to be estimated, and ε_i is the error term.

The variables that were used in our study are described below (Table 1) along with their expected sign.

Table 1. Variable definitions and their expected sign for the regression model

Variables	Dimension	Description	Value	Expected sign
Dependent				
WTI	Dummy	Decision to insure or not	Adopter =1, Otherwise 0	
WTPamt	Integer values	Willingness to pay amount		
Independent				
X_1 (Gender)	Dummy	Gender of dairy farmers	1 if male, 0 otherwise	+
X_2 (Age)	Continuous	Age of dairy farmers	Years	-
X_3 (Mar_status)	Dummy	Marital status	1 if married, 0 otherwise	+
X_4 (Edu)	Dummy	Education level of farmers	1= formal, 0 = no education	+
X_5 (Rear_exp)	Continuous	Cattle rearing experience	Years	±
X_6 (HHsize)	Integer	Household size	Number	±
X_7 (Liv_loss)	Dummy	Whether the respondents had experienced livestock loss in the last five years	Loss occurred= 1, otherwise 0	+
X_8 (Awareness)	Dummy	Whether the respondents are aware of livestock insurance	1 if yes, 0 otherwise	+
X_9 (Training)	Dummy	Whether the respondents have received training on livestock insurance	Received =1, Otherwise 0	+
X_{10} (Dairy_Inc)	Continuous	Income from dairy animals	Amount (NRs.)	+
X_{11} (Other_Inc)	Continuous	Income from other than dairy animals	Amount (NRs.)	+
X_{12} (Num_cattle)	Continuous	Number of cattle/Buffalo	Number	+
X_{13} (Membership)	Dummy	Membership in social organization/cooperatives	1 if yes, 0 otherwise	+
X_{14} (For_employ)	Dummy	Migration status of the household	Yes = 1, Otherwise 0	+
X_{15} (Breed)	Dummy	Breed of cattle	1 if improved, 0 if Local	+
X_{16} (Cattle shed)	Dummy	Cattle shed	1= traditional, 0 otherwise	-
X_{17} (Loan_access)	Dummy	Access to loan	1 if yes, 0 otherwise	+

3. Results and Discussion

3.1. Demographic and Socioeconomic Characteristics of Respondent Households

Out of 150 surveyed farmers from the Dang district, the largest group (43%) was from Ghorahi, followed by 35% from Tulsipur, and 32% from Lamahi, illustrating a balanced geographic distribution across the region (Table 2). Male farmers predominated the respondent demographic, representing 69% of the total, which suggests that women's historic lack of decision-making rights has hindered their engagement in agriculture and agri-economic decisions. The involvement of women in the survey, accounting for 31% of respondents, may be indicative of the broader socio-economic transition wherein women engage in diverse professions beyond the agricultural sector, including science, commerce, and social roles within urban settings.

Table 3 presents the age distribution of respondents in our study. Respondents were predominantly from the age group of 41-50 years, constituting approximately one-third (33.3%) of the sample, indicative of a mature segment actively engaged in decision-making. This was closely followed by those in the 31-40- and 51-60-age groups, accounting for 29.3% and 19.3% of respondents, respectively. However, it was observed that younger individuals aged 20-30 showed minimal engagement, comprising just 10.7% of the total. This underrepresentation may be attributed to perceptions of dairy farming's profitability and career prospects, which are influenced by factors including perceived opportunities, personal attitudes, and geographic location (Khanal et al., 2021). A mere 7.3% of the surveyed population were seniors above the age of 61, highlighting the involvement of primarily the working-age population in cattle farming. The distribution of ages in the study provides a diverse perspective, adding credibility to the findings by mitigating age-related biases.

Table 2. Distribution of respondents by sex

Variables		Gender (N= 150)		
		Male	**Female**	**Total**
Address	Ghorahi	45 (20)	20 (13)	65 (43)
	Tulsipur	32 (21)	16 (11)	48 (35)
	Lamahi	26 (17)	11 (7)	37 (32)
Total		103 (69)	47 (31)	150 (100)

Note: Number in the parentheses indicate percentages of the total

Table 3. Age-wise distribution of the respondents

Category		Frequency (N= 150)	Percent (%)
Age group of the respondent	20 - 30	16	10.7
	31 - 40	44	29.3
	41 - 50	50	33.3
	51 - 60	29	19.3
	61 above	11	7.3
	Total	150	100
	Mean (SD)	43 (10.36)	
	Minimum	28	
	Maximum	64	

The socio-demographic characteristics of the survey respondents, shown in Table 4, reflect diversity in ethnicity, marital status, and education. Ethnically, Brahmin/Chhetri represent nearly half of the sample (48%). Janajatis comprise 23.3%, followed by Dalits at 10%. The remainder (18.7%) of the respondents are from other ethnic backgrounds. This study assumed that ethnicity has no role in affecting farmers' willingness to insure and pay for cattle insurance as the author highly believes that decision-making is influenced by one's cognition but not by ethnic tags. Respondents' marital status shows a few (11%) respondents being single, a majority (89%) married and none of them divorced. The educational levels are used to measure the ability to read and positively relate to insurance uptake. While 16.7% have not received any formal education, a substantial segment of the sample, 40%, have completed primary education. This is followed by nearly a third, 28.7%, who have reached secondary education levels. Additionally, a considerable proportion, 14.7%, have advanced their education to university-level degrees. The study thus captured a broad educational cross-section of the agricultural community, from those with no formal education to university graduates.

Table 4. Social characteristics of the respondents

Variables	Category	Frequency	Percent
Ethnicity of HH	Brahmin/Chettri	72	48.0
	Janajati	35	23.3
	Dalit	15	10.0
	Others	28	18.7
Marital status	Unmarried	17	11.3
	Married	133	88.7
Educational level	Illiterate	25	16.7
	Primary	60	40.0
	Secondary	43	28.7
	Graduate	22	14.7

The study's participants mainly engage in agriculture–around 45% of the sampled households indicated farming as their primary occupation (Table 5). Services, business, and other occupations account for nearly an equal share of the remaining workforce. This dominance of farming over other occupations signified the importance of agriculture in the district's economy and farmer's way of rural livelihood. Regarding awareness of cattle insurance, 22% of farmers gained information from extension agents, with fellow dairy farmers and financial institutions also playing key roles (Table 5). Regular interactions with extension agents have likely facilitated the uptake of insurance, which many farmers adopt in compliance with obligatory regulations. The survey examined the perceptions regarding the reliability of cattle insurance as a risk mitigation strategy. With 70% affirming cattle insurance as a reliable mechanism, the majority viewpoint leans towards trust in the efficacy of cattle insurance (Table 5). This implies that among the participants, there is a significant inclination to regard cattle insurance as a reliable approach to protect against the risks associated with cattle farming.

Table 5. Occupation, reliability, and information sources

Variables	Frequency	Percent
Major Occupation		
Agriculture	68	45.3
Service	27	18
Business	26	17.3
Others	29	19.3
Do you consider cattle insurance as a reliable risk coping mechanism?		
No	45	30
Yes	105	70
Through which of the following means did you know about Cattle Insurance?		
Fellow dairy farmers	32	21.3
Media (TV, radio, newspapers)	16	10.7
Banks or Financial Institutions	29	19.3
Extension agents	33	22
NGOs	20	13.3
Others	20	13.3

3.2. Farmers' Willingness to Insure and Pay a Premium for Cattle Insurance

Dairy farmers' willingness to insure and willingness to pay a premium for insurance per annum is presented in Table 6 and Table 7. Nearly three-fourths (72%) of the dairy farmers were willing to insure their cattle farms, while the rest of them indicated a reluctance to do so. 78% of the respondents had awareness of the insurance scheme (Table 6).

Table 6. Awareness of respondent farmers and their willingness to insure dairy animal

		Willingness to insure		
		No	**Yes**	**Total**
Awareness of insurance scheme	No	24 (16)	9 (6)	33 (22)
	Yes	18 (12)	99 (66)	117 (78)
	Total	42 (28)	108 (72)	150 (100)

Table 7. Farmers' willingness to pay for crop insurance

Variable	Description	Percentage
Percentage of value of cattle, farmers are willing to pay as premium	1	2.1
	5	73.5
	10	23.2
	15	1.2
Minimum cost of insuring (premium) for cattle insurance/ annum	$48	
Maximum cost of insuring (premium) for cattle insurance/ annum	$71	
Average cost of insuring (premium) for cattle insurance	$58	

Dairy farmers indicated a willingness to pay different amounts for insurance premiums on an annual basis: up to $71 as the maximum, $42 as the minimum, and an average of $58, with the exchange rate being 1 Nepalese Rupee equal to 0.0076 US Dollar (Table 7). Approximately three-fourths of the dairy farmers were willing to pay 5% of cattle value as insurance premiums. This disposition aligns with Khan et al. (2013), who observed a comparable willingness among their study's Indian respondents to engage in a cattle insurance scheme with a 5% premium based on the value of the cattle. Slightly less than one-fourth of the respondents were willing to pay 10 % of their cattle value as a premium, while very few groups were open to paying either 1% or 15% of the cattle's value.

3.3. Factors Influencing Farmers' Willingness to Insure and Willingness to Pay for Cattle Insurance

The probit regression result shown in Table 8 explores the determinants of cattle insurance adoption among farmers. The robustness of the model is confirmed by the Wald test (LR chi^2), indicating that the explanatory variables collectively have a significant impact on the likelihood of insurance adoption. The Pseudo R^2 is 0.72, which means the variables included in the model were able to explain about 72 percent of the probability of respondents' decision to adopt or not to adopt cattle insurance.

The factors influencing farmers' willingness to insure and willingness to pay the amount for cattle insurance are presented in Table 8. Gender has a significant influence on willingness to insure cattle insurance, corroborating the findings of O'Reilly et al. (2018), who noted a substantial link between gender and insurance adoption. However, gender does not significantly affect the willingness to pay for insurance. Contrary to expectations, farmers' age significantly influences both the propensity to insure and the willingness to pay, at a 5% significance level. The results show an increase in these tendencies with age, suggesting that older farmers are more inclined to insure, likely due to a more cautious attitude to risk management. Specifically, for each additional year of a farmer's age, there is a 0.024 USD increase (equivalent to NRs. 3.12) in the willingness to pay and a 1.5% increase in willingness to insure. Marital status, while not significant in predicting the willingness to insure, does significantly (at the 1% level) affect the amount farmers are prepared to pay, with married farmers willing to pay $5.6792 less in premiums.

Table 8. Factors influencing farmers' willingness to insure and pay for cattle insurance (Results for Double-hurdle model)

Willingness to Insure			**Willingness to pay**
Probit			**Tobit**
Variables	**dy/dx (Marginal effects)**	**estimate**	**estimate**
Constant		-1.31(1.958)	52.5123 (47.932)
Gender	-0.0009	-0.94** (0.3968)	-0.5174 (4.126)
Age	0.015	0.085** (0.0462)	0.0241*** (0.14218)
Mar_status	0.311	0.661 (0.7377)	-5.6792*** (4.00132)
Edu_level	0.0281	0.281** (0.2954)	-3.1928 (3.1534)
Rear_exp	-0.0347	-0.477*** (0.118)	0.5492 (0.1129)
HHsize	-0.0172	-0.324*** (0.2368)	1.0847*** (0.6918)
Liv_loss	0.105	1.25** (0.6088)	0.782*** (3.0012)
Awareness	0.225	2.446*** (0.726)	3.124 (1.2731)
Training	0.614	0.41 (0.4821)	1.2897 (0.1246)
Dairy_Inc	0.004	0** (0.045)	-2.59** (3.48695)
Other_Inc	-0.0183	0 (0.5109)	0.41** (1.41968)
Num_cattle	0.009	0.081** (0.142)	0.015** (1.2003)
Membership	0.0038	0.386 (0.4856)	0.03 (0.154)
For_emp	0.0162	0.12 (0.5208)	0.113 (1.453)
Breed	0.0006	0.549 (0.488)	-0.458** (1.467)
Cattle shed	-0.0509	-0.416 (0.468)	0.1138 (0.017)
Loan_access	0.301	1.34** (0.7644)	0.348*** (1.035)
Regression diagnostics			Regression diagnostics
Number of observations		150	Cragg & Uhler's R^2: 0.712
Likelihood Ratio Chi-Square[a] (df= 17)		114.31	Efron's R^2: 0.514
Mc Fadden's Rho-Squared or Pseudo R^2		0.72	McKelvey & Zavoina's R^2: 0.618
Goodness of Fit[a]			Count R^2: 0.886
Pearson Chi-Square		188.058	AIC: 0.496
Log Likelihood[b]		-31.458	Variance of y*: 3.185
Akaike's Information Criterion (AIC)		98.916	Variance of error: 1
Finite Sample Corrected AIC (AICC)		104.178	
Bayesian Information Criterion (BIC)		152.987	
Consistent AIC (CAIC)		170.987	

Significance levels: * p<0.1, ** p<0.05, *** p<0.01, Standard error in the parentheses

Educational level positively and significantly impacts the willingness to insure at a 5% significance level. This aligns with prior expectations and is in line with the findings of Danso-Abbeam et al. (2014), suggesting that formally educated farmers are more equipped to assess and adopt insurance. Wiredu et al. (2013) further clarify that formal education enhances farmers' capacity for critical analysis and informed decision-making regarding agricultural technologies. However, education does not significantly influence the premium farmers are willing to pay for insurance, which implies that while education fosters a recognition of the value of insurance, it does not necessarily translate to higher premium payments. This result is consistent with findings from Hill et al. (2013), who observed that

Ethiopian farmers with higher educational levels are more likely to purchase agricultural insurance, probably due to a better understanding of its benefits compared to their less-educated peers.

The farmers' experience in cattle rearing significantly and negatively influences the adoption of cattle insurance. Specifically, for each additional year of experience, the probability of adopting an insurance program decreases by 3.47%, assuming all other variables are held constant. This may be attributed to the fact that experienced farmers are likely to have developed a range of other risk management strategies beyond insurance. Similarly, household size was found to be statistically significant at the 1% level and negatively impacts a farmer's willingness to insure their dairy farm. For every additional member in a household, willingness to insure by a farmer decreases by 17.2%. This finding corresponds with the research conducted by Subedi and Kattel (2021) in southern Nepal. Conversely, the Tobit model indicates that the amount a farmer is willing to pay for insurance increases by $1.08 for each additional household member. Farmers with a loss history are 10.5% more likely to purchase insurance than those who have not experienced a loss. Similarly, the willingness to pay a higher insurance premium—reflected by an increase of $0.782—is compared to farmers who did not suffer any losses. Farmers' awareness of insurance programs offered under a particular scheme significantly affects their participation, with a 1% level of significance. The probit model analysis suggests that farmers aware of the insurance program are 22.5% more likely to insure their livestock compared to their counterparts who lack such awareness. This further supports the conclusions of Khan et al. (2013), which emphasize the role of awareness in motivating farmers to participate in livestock insurance.

Income derived from cattle farming has a significant positive effect on a farmer's willingness to insure. However, an increase in dairy income was found to be associated with a reduction in the premium a farmer is willing to pay for insurance, a decrease of $2.59 for each dollar increase in income, contradicting initial expectations. This may indicate that higher dairy farm income reduces concern over potential farm risks, thereby diminishing the perceived need for insurance.

Interestingly, income from other sources did not have a significant influence on the willingness to insure cattle farms but showed a positive and significant relationship with the willingness to pay a higher insurance premium. This result could indicate that income diversification provides a sense of financial security, reducing the urgency to insure. However, those with diversified income sources are likely to allocate more funds to insurance premiums if they choose to insure. The Tobit regression analysis reveals that for each additional dollar of income from other sources, the willingness to pay (WTP) a premium for insurance increases by $0.41.

The number of cattle on a farm significantly affects a farmer's decision to adopt insurance, with a 5% level of significance indicating a positive relationship. Consequently, an increase in cattle count enhances the likelihood of a farmer insuring the farm; specifically, each additional cattle head raises this probability by 0.9%. Moreover, the premium that farmers are willing to pay for insurance also rises alongside the number of cattle, with an increment of $0.015 in the premium for each additional number of cattle. The breed of cattle, while not impacting the willingness to insure (WII), exhibited a negative effect on the willingness to pay (WTP) a premium for insurance. An improved breed correlates with a reduction of $0.458 in the premium a farmer is willing to pay. Access to loans enhances both a farmer's willingness to insure and the amount they are willing to pay for such coverage. This observation is consistent with the work of Falola et al. (2013), which also identified a positive relationship between loan access and insurance adoption. Farmers who have loan access are 30.1% more likely to insure their farms, and they also tend to pay a higher insurance premium by $0.348. In contrast, factors such as training received, social memberships, foreign employment, and the type of cattle shed demonstrated no significant impact on either the willingness to insure or the willingness to pay for cattle insurance in this study.

3.4. Reasons for Non-Purchase of Cattle Insurance Policies

Table 9 shows the reasons for the non-purchase of cattle insurance policies by dairy farmers. 28 percent of the interviewed farmers had not adopted the cattle insurance programs. Their non-adoption is driven by various factors. Insufficient information about cattle insurance constitutes the main reason (26%) for non-subscription. This is confirmed by findings by Addey et al. (2021) that showed inadequate information about insurance hindered uptake. In our Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs), it was noted that gender and educational level played a role in this low adoption rate, with women, in particular, displaying less engagement with cattle insurance, likely due to lower financial literacy, education, and information. Another reason for non-adoption included low awareness about the insurance and complex procedures involved in the subscription of the program. We observed that awareness about cattle insurance is important, but it does not guarantee subscription. A deeper understanding of how the specific insurance products work in addition to knowledge about the product is more likely to complement and encourage farmers to subscribe.

Table 9. Reasons for not joining cattle insurance

Reasons for not joining cattle insurance	Multiple response	
	Frequency	Percentage
Not aware of cattle insurance	8	19.05
No need of cattle insurance due to small herd size	2	4.76
Expensive	4	9.52
Insufficient information about cattle insurance	11	26.19
Complex procedure needed for attainment of cattle insurance	8	19.05
Weak faith in scheme provided by the agencies	3	7.14
Historical observation of delay in claim payment	2	4.76
Post-mortem of animal not done in due course of time	4	9.52
	N= 42	100

A smaller proportion of farmers (9%) perceived cattle insurance to be expensive (Table 9), which is in agreement with the findings of Santeramo et al. (2016) which identified the cost of insurance as a limiting factor for small-scale farmers. The qualitative data also pointed to distrust in the insurance schemes offered by agencies, a sentiment particularly strong among the adult population, consistent with the findings of Ankrah et al. (2021). Other reasons include delays in the post-mortem of animals, smallholder farmers with a low number of cattle, and historical observation of delays in claim payment. Our study reveals that a lack of information and understanding about cattle insurance is prevalent among a significant portion of respondents (about 45%). This deficiency in knowledge may have led some farmers who might otherwise be interested in purchasing insurance to postpone their decisions. Improved education and simplification of the insurance processes could potentially increase policy uptake. Fletschner and Kenney's (2014) research on Philippine dairy

farmers corroborates this, determining insufficient information on cattle insurance as a barrier to its adoption.

3.5. Risk Management Strategies

Farmers employ various strategies to mitigate the risks inherent in their profession, often utilizing a mix of approaches and tools. Some strategies deal with only one kind of risk, while others address multiple risks. Table 10 shows the frequency distribution of seven risk management strategies that dairy farmers have implemented within the context of the study areas. Additionally, the table assigns a ranking to these strategies, with the most frequently adopted strategy receiving the first rank, and so on. Data from Table 10 indicates that a majority of cattle farmers in the study areas (32%) are adopting cattle insurance schemes to diversify risk. This is the most common strategy, followed by efforts to produce livestock at the minimum possible cost (21%), maintaining a healthy environment and sanitation (14%), and the administration of vaccinations to the cattle. Other risk management tactics include generating off-farm income, engaging in cooperative marketing, and managing debt. Cattle insurance pays indemnities to farmers whenever animal is injured or suffers from any kind of abnormalities that reduces ultimate yield. Earning off-farm income or making off-farm investments can offer a steadier stream of revenue to complement traditional farming activities. Cooperative marketing efforts help farmers manage risk by securing guaranteed prices, market outlets, or pre-agreed terms of trade. Vaccinating cattle serves as a proactive measure, guarding against the future risk of disease outbreaks.

Table 10. Risk Management Strategies adopted by dairy farmers

Risk management strategy	Frequency (n=150)	Percentage	Rank
Cattle insurance	48	32	1
Produce at lowest possible cost	32	21.33	2
Proper sanitation	22	14.67	3
Vaccinations	16	10.67	4
Off-farm income	16	10.67	5
Cooperative marketing	9	6	6
Debt management	7	4.67	7

4. Conclusion

The study reveals that the majority of cattle farmers are primarily engaged in agriculture, highlighting the significance of cattle farming in the study areas. Although 78% of the respondents were aware of the cattle insurance scheme, 72% of the dairy farmers were willing to insure their cattle farms. This shows that cattle insurance is popular among dairy farmers. However, less than three-fourths of the farmers were willing to pay the insurance premium equivalent to more than 10% value of the cattle, while more than three-fourths were willing to pay 5% of cattle-value as a premium. The average cost of premium for insurance was $58/ farm/annum. Certain factors had a positive impact on cattle farmers' willingness to insure their farms, including age, education, awareness of insurance schemes, historical livestock loss, dairy farm income, number of cattle, and access to loans. Conversely, factors like gender, cattle rearing experience, and household size negatively influenced their willingness to insure. Additionally, factors such as age, household size, historical livestock loss, off-farm income, number of cattle, and access to loans positively influenced the premiums cattle farmers were willing to pay, while factors like marital status, dairy farm income, and cattle breed had a negative impact on the premiums they were willing to pay.

Recommendations include educating cattle farmers about livestock insurance to enhance awareness and willingness to pay higher premiums. Involving farmers in insurance scheme planning can help determine suitable premiums, with a need for further research on premium preferences and influencing factors. Generalizing research findings to the national level is advisable, emphasizing the importance of farmer education and involving organizations or cooperatives as professional insurance agents. Expanding the number of insurance agents, providing training and materials in local languages, and investing in dairy sector development can drive demand for livestock insurance without subsidies, offering long-term sustainability.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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