

**Research Article:****ADOPTION OF IMPROVED WHEAT VARIETIES IN NAWALPARASI WEST DISTRICT, NEPAL****Aayushma Acharya<sup>a</sup>**, **Sushmita Bhatta<sup>b</sup>** and **Binayak Prakash Mishra<sup>c\*</sup>**<sup>a</sup>Nepal Polytechnic Institute, Purbanchal University, Bharatpur, Chitwan, Nepal<sup>b</sup>Department of Agricultural Economics and Agribusiness Management, Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal<sup>c</sup>Department of Agricultural Extension and Rural Sociology, Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal

\*Corresponding author: binayakprakash.mishra@gmail.com

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**ABSTRACT**

The adoption of improved wheat (*Triticum aestivum* L.) varieties is crucial for enhancing productivity and ensuring food security in Nepal. The study aimed to examine the adoption of improved wheat varieties in Nawalparasi West district, Nepal. It focused on adoption patterns, the factors influencing adoption, and the reasons for farmers' decisions to adopt or not adopt these varieties. Additionally, the study explored farmers' information sources, perceptions, and support needs. Primary data were collected in 2025 from 120 randomly selected farmers using a pretested semi-structured interview schedule. The results reveal that adoption of improved wheat varieties was positively influenced by male-headed households, commercial nature of production, and access to input markets. A negative association with adoption was observed for education and access to output markets. The varieties Vijay and Bhrikuti were adopted for longer periods and comparatively over larger farm areas. Farmers who did not adopt improved varieties reported unfamiliarity with benefits and high seed costs as the main reasons for non-adoption. Adopters highlighted high yield, superior grain quality, and disease/pest resistance as the reasons for adoption. Major challenges in the adoption of improved varieties were limited access to fertilizers and irrigation, and insufficient technical knowledge of recommended production practices. Fellow farmers and farmer groups or cooperatives were the major sources of information on improved varieties. Farmers expressed positive perceptions regarding yield, grain quality, and pest/disease resistance, and emphasized the need for support on resources and subsidies. Thus, strengthening access to input markets and fostering a shift toward commercial-oriented production systems are crucial for accelerating the adoption of improved varieties.

**Keywords:** Commercial, market, perception, subsidies**INTRODUCTION**

Wheat (*Triticum aestivum* L.) contributed 5.88 percent to the agricultural GDP in FY 2080/81 (2023/24), highlighting its importance in the national economy of Nepal. It is the third most widely grown crop in terms of cultivated area, after paddy and maize. In 2022/23, wheat was planted on 697,762 hectares, producing 2,098,462 metric tons with an average yield of 3.01 metric tons per hectare (MoALD, 2024).

The Terai region of Nepal, although being its main wheat belt, lags behind regional averages in yield (Adhikari et al., 2021; Devkota et al., 2023; Nyaupane et al., 2023; Sukumaran et al., 2021). Nepal is heavily dependent on cereal imports to meet domestic demand (Katel et al.,

2023). Import records of 2022/23 highlighted 59,000 kilograms of durum wheat seed, 6,571,249 kilograms of other durum wheat, 33,851 kilograms of wheat seed, 1,130,375 kilograms of wheat gluten whether or not dried, and 362,380 kilograms of wheat or meslin flour (excluding maida), collectively amounting to several hundred million Nepalese Rupees (MoALD, 2024).

The yield gap of wheat is estimated at 1.6-4.6 t/ha in Nepal, with average gaps at 3.0 t/ha between current and attainable yields (Basukala & Rasche, 2022; Devkota et al., 2023; Devkota et al., 2018; Marasini & Amgain, 2021). The main reasons behind the gap are suboptimal fertilizer use, inadequate irrigation, delayed sowing, use of older varieties, and poor agronomic practices (Basukala & Rasche, 2022; Bhatta et al., 2020; Devkota et al., 2023; Devkota et al., 2018; Marasini & Amgain, 2021; Thapa et al., 2020). This loss is further accelerated by climate risks, especially terminal heat and water stress (Dahal et al., 2021; Devkota et al., 2023; Ghimire et al., 2024; Kaini et al., 2022; Thapa et al., 2020).

Nepal's Agriculture Development Strategy (ADS) highlights the vital role of improved varieties in transforming Nepal's cereal sector. The strategy observed low productivity, food insecurity, heavy reliance on imports, weak competitiveness, and vulnerability to climate shocks as the persistent challenges in Nepalese agriculture. It highlights that all of these challenges are linked to limited adoption of improved varieties. Adoption of improved varieties is viewed as a contributing factor to meet ADS priorities by raising productivity, strengthening food and nutrition security, enhancing market competitiveness, and building resilience through stress-tolerant and disease-resistant varieties (MoAD, 2016).

Although Nawalparasi West district, located in the Terai region, is considered a major hub for wheat production in Lumbini province, wheat productivity in Nawalparasi West (3.15 t/ha) remains below the provincial average of Lumbini Province (3.34 t/ha) (MoALD, 2024), indicating underlying gaps in the adoption of improved production practices and the presence of location-specific constraints (Poudel et al., 2021). This yield disparity underscores the need for a systematic assessment of factors influencing technology adoption. Previous studies primarily focused on identifying the factors affecting the adoption of improved wheat varieties and are confined to other regions than Nawalparasi West district (Adhikari & Lamichhane, 2018; Bhatta et al., 2022; Royaka & Pandey, 2025; Subedi et al., 2019a, b). The objectives of this study are to identify the factors influencing the adoption of improved wheat varieties and to examine the duration of adoption in relation to cultivated area. The study also aims to explore farmers' reasons for adopting or not adopting these varieties, assess their sources of information and perceptions, and understand their support needs to enhance adoption. The findings are expected to provide policymakers with valuable insights for designing effective strategies to promote the adoption of improved wheat varieties among farming communities.

## THEORETICAL FRAMEWORK

The adoption of improved agricultural technologies, including wheat varieties, is a complex behavioral process influenced by multiple socio-economic, institutional, and psychological factors. This study is grounded in two complementary theoretical perspectives: Rogers' Diffusion of Innovation (DoI) theory and the Theory of Planned Behavior (TPB).

Rogers' Diffusion of Innovation theory explains how new technologies spread within a social system over time. According to this theory, adoption decisions are influenced by key attributes of the innovation, including relative advantage, compatibility, complexity, trialability, and observability. In the context of improved wheat varieties, farmers are more likely to adopt technologies they perceive as economically beneficial (e.g., higher yield), compatible with

existing farming practices, and easy to use and test. Social interactions, such as communication among farmers and within cooperatives, also play a critical role in accelerating diffusion.

Complementing this, the Theory of Planned Behavior emphasizes that individual behavior is shaped by intention, which in turn is influenced by attitudes, subjective norms, and perceived behavioral control. Farmers' attitudes toward improved wheat varieties (e.g., perceptions of yield and resilience), social pressures from peers or institutions (e.g., farmer groups, extension agents), and their perceived ability to access resources (e.g., inputs, credit, irrigation) collectively determine their adoption decisions.

Based on these theoretical perspectives, this study incorporates variables representing individual characteristics (gender, age, education, experience), economic factors (income, farm size, commercialization), and institutional factors (extension contact, cooperative membership, access to inputs, credit, irrigation, subsidies, and markets). Integrating DoI and TPB provides a comprehensive analytical framework to examine both the diffusion process and behavioral drivers underlying the adoption of improved wheat varieties.

## RESEARCH METHODS

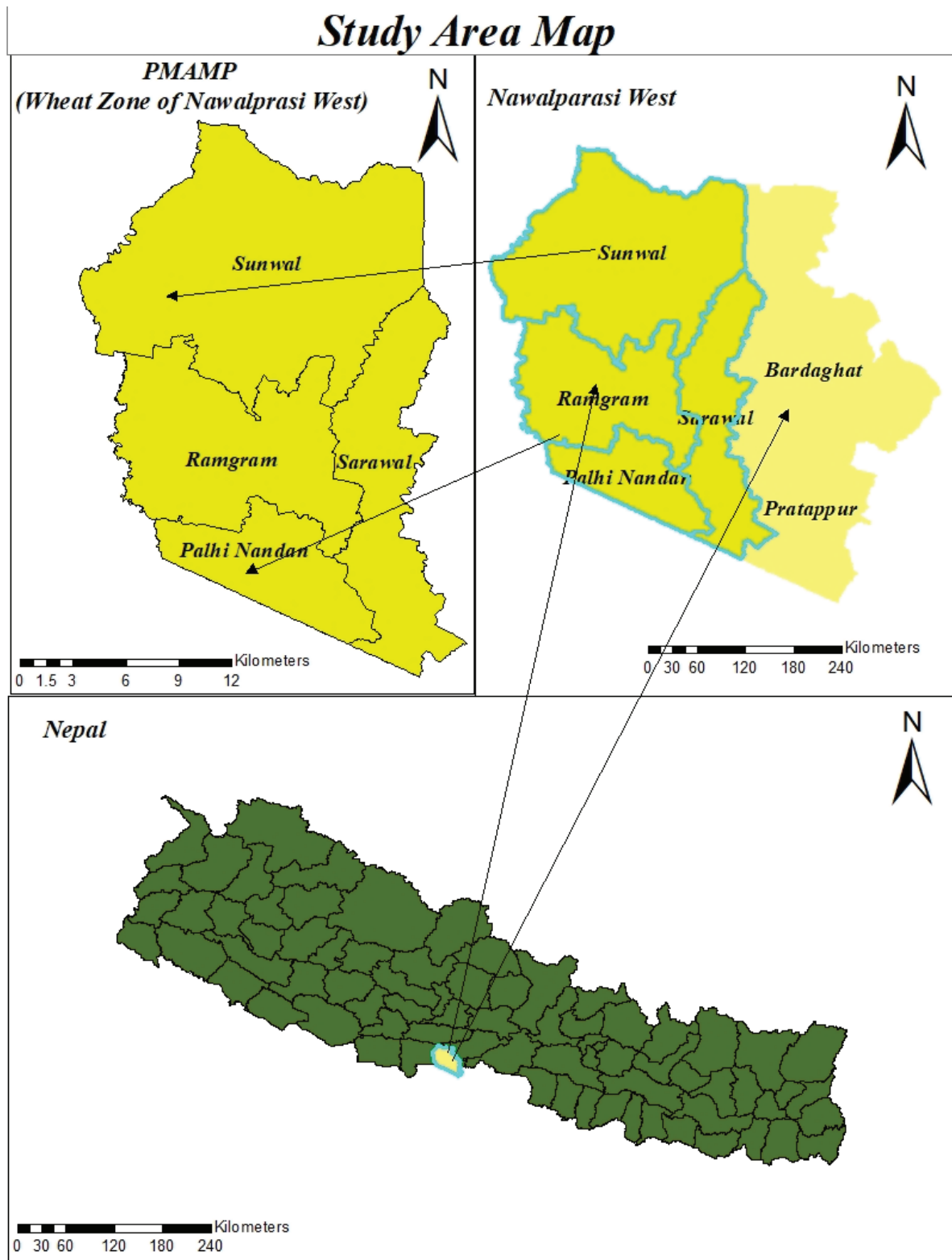
Nawalparasi West, located in Lumbini Province, is a significant wheat-producing district with an area of 8,500 ha, yielding 26,775 metric tons at an average of 3.15 t/ha. At the provincial level, Lumbini encompasses 160,181 ha of wheat cultivation, producing 535,020 metric tons with an average yield of 3.34 t/ha, making it the second-largest contributor in the country after Madhesh Province (MoALD, 2024). Despite its high potential, wheat productivity in Nawalparasi West remains below the provincial average, highlighting the need to investigate production constraints and adoption of improved practices. Therefore, this study was conducted in Lumbini Province, specifically selecting Nawalparasi West as the study district, to provide insights into region-specific challenges and opportunities for enhancing wheat production and productivity. Further, Ramgram Municipality (ward 16 and 18), Sunwal Municipality (ward 11 and 12), Sarawal Rural Municipality (ward 3 and 4), and Pahlinandan Rural Municipality (ward 6) were purposively selected within the district as it falls under the command area of the PMAMP wheat zone. The study focuses on the PMAMP command area for wheat because it is a priority zone for wheat production and modernization in Nepal. This area provides a setting where improved input supply, extension support, and planned interventions are actively promoted, influencing farmers' adoption decisions. Examining adoption in this context helps identify key factors, barriers, and opportunities for scaling up improved wheat varieties. Using random sampling technique, 120 farmers were selected from the list of registered farm households within the command area. Further sample size was divided into two categories of adopters and non-adopters to improved wheat varieties. To calculate sample size, we used the formula (Daniel, 1999);

$$n = N * X / (X + N - 1),$$

Where,

$$X = Z_{\alpha/2}^2 * p * (1-p) / MOE^2,$$

and  $Z_{\alpha/2}$  is the critical value of the Normal distribution at  $\alpha/2$  (for a confidence level of 95%,  $\alpha$  is 0.05 and the critical value is 1.96), MOE is the margin of error (8%),  $p$  is the sample proportion (50%), and  $N$  (575) is the population size.



**Fig. 1. Study area located in map of Nepal**

A household survey was conducted using a pretested semi-structured interview schedule to gather primary data in 2025. Pretesting was conducted in Rupandehi district with 20 farmers to ensure the clarity, relevance, and reliability of the questionnaire. Feedback from the pretest was used to refine the questions, adjust wording, and ensure all items were understandable and contextually appropriate before the main survey. To validate the data obtained through household survey, 5 Key Informant Interview (KII) and 4 Focus Group Discussion (FGD) were

carried out. In general, FGD were carried out with farmers in group of 6-10 members, while KII were carried out with extension workers, executive members of agricultural cooperatives, local representatives and progressive farmers. KII and FGD covered farmers' awareness and adoption patterns of improved wheat varieties, factors influencing adoption, reasons for adoption or non-adoption, sources of information, perceptions of improved varieties, and support needs to enhance adoption. The qualitative insights from FGD and KII were not analyzed separately but were used to support, explain, and enrich the interpretation of survey results.

Descriptive analysis and probit model were employed using software application (Stata/BE 17.0). Probit model was used to identify the determinants of adoption of improved wheat varieties. Marginal effect on those variables were estimated in the probit model, to assess the effect of each independent variable on the adoption. The probit model is widely used in adoption studies where the dependent variable is binary (Dhakal & Mishra, 2022; Mishra, 2021; Rijal et al., 2025). This model was used to identify the determinants (regressors) on the probability of adoption of improved varieties (regressand). The likelihood of farmers adopting improved varieties is a non-linear function of regressors. The probit model used is of the form  $\Pr(Y = 1) = \Phi(X_i\beta)$  where  $\Pr(Y = 1)$  represents the probability of adopting improved varieties with the change in X variable. A positive estimated coefficient implies an increase in likelihood of adoption of improved varieties. The probit model establishes a relationship between probability values and explanatory variables and ensures the probability value between 0 and 1. In probit model, let us suppose  $Y_i$  is the binary response of the farmers,  $Y_i = 1$ , if the farmer adopt improved varieties, and  $Y_i = 0$  if the farmer does not adopt the improved varieties.

If  $Y_i = 1$ ;  $\Pr(Y_i = 1) = P_i$

If  $Y_i = 0$ ;  $\Pr(Y_i = 0) = 1 - P_i$

Where  $P_i = E(Y = 1/X)$  represents the conditional mean of Y given certain values of X.

Previous studies (Subedi et al., 2019a, b) also used this model in identifying the factors affecting adoption of improved wheat varieties in Nepal. For the remaining objectives, the number of respondents in each category was determined using frequency analysis to examine the adopted improved wheat varieties, barriers and challenges to adoption, reasons for adoption or non-adoption, farmers' perceptions of improved varieties, and their desired support. Prior to model estimation, diagnostic tests were conducted to ensure the reliability of the estimated coefficients. Multicollinearity among explanatory variables was assessed using the Variance Inflation Factor (VIF). In addition, a bivariate correlation analysis was performed between key variables to examine potential pairwise associations.

Model specification:

$$\Pr(Y = 1) = f(b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + b_9 X_9 + b_{10} X_{10} + b_{11} X_{11} + b_{12} X_{12} + b_{13} X_{13} + b_{14} X_{14} + b_{15} X_{15})$$

Where,

$\Pr(Y = 1)$  = Probability of adoption of improved wheat varieties

$X_1$  = Gender (dummy);  $X_2$  = Age (continuous);  $X_3$  = Education (continuous);  $X_4$  = Off-farm income (dummy);  $X_5$  = Income (continuous);  $X_6$  = Production (dummy);  $X_7$  = Membership (dummy);  $X_8$  = Contact (dummy);  $X_9$  = Farm size (continuous);  $X_{10}$  = Experience (continuous);  $X_{11}$  = Input market (dummy);  $X_{12}$  = Credit (dummy);  $X_{13}$  = Irrigation (dummy);  $X_{14}$  = Subsidy (dummy);  $X_{15}$  = Output market (dummy)

$b_0$  = intercept (constant term)

$b_1, b_2, \dots, b_{15}$  = Probit coefficient

The description of the variables is presented in Table 1.

## RESULTS AND DISCUSSION

### Descriptive statistics

The descriptive statistics of variables are presented in Table 1. In the study area, 74.16% of respondents have adopted improved wheat varieties. Likewise, 74.16% of the sampled households were male-headed, and the average age of the household head was 47.38 years. On average, respondents had 6.29 years of formal schooling. The average annual household income was NPR 314,750. On average, 48.33% of the respondents were involved in commercial production and have an average farming experience of 20.94 years. An average farm size was 17.36 kattha. Similarly, 42.5% of households received off-farm income, and 54.16% of respondents were members of agricultural cooperatives or farmer groups. Regular contact with extension workers was reported by 20% of respondents. Access to local markets for input was available to 81.66% of respondents, access to credit to 80.8%, access to irrigation to 56.66%, and access to subsidies to 19.16%. Similarly, 51.66% of respondents had access to output markets.

The high adoption of improved wheat varieties in Nawalparasi West suggests stronger implementation of modern practices among farm households than seen in broader crop-level improved seed use reported nationally, where improved seed use remains limited for many staples. Households reported relatively high access to input markets and credit, which appears more favorable than general national agricultural resource conditions. However, access to irrigation in the study area is moderate. The predominance of male-headed households locally aligns with the national pattern (CBS, 2022).

The descriptive statistics show identical mean and standard deviation values for the dependent variable (adoption of improved wheat varieties) and the gender variable. To verify whether this reflects a potential data issue or multicollinearity, a bivariate correlation analysis was conducted. The correlation coefficient between gender and adoption was found to be  $r = 0.1301$ , indicating a weak positive relationship. This confirms that the similarity in summary statistics is coincidental and does not imply perfect or near-perfect correlation.

Furthermore, multicollinearity diagnostics using the Variance Inflation Factor (VIF) show that all variables fall well below the commonly accepted threshold of 10, with a mean VIF of 2.34. This confirms that multicollinearity is not a concern, and the estimated coefficient for gender remains statistically reliable and interpretable within the probit model.

**Table 1. Descriptive statistics of the variables used in the study**

Variable	Description	Mean	Standard Deviation
Dependent variable			
Improved varieties	= 1 if respondent has adopted improved wheat varieties, 0 otherwise	0.7416	0.4395
Independent variable			
Gender	Gender of the respondent (1-male, 0-female)	0.7416	0.4395
Age	Age of the respondent (year)	47.3833	12.7293
Education	Formal schooling of the respondent (year)	6.2916	4.5233
Off-farm income	= 1 if household receive off-farm income, 0 otherwise	0.425	0.4964
Income	Annual income of household (NPR)	314750	174538.80
Production	= 1 if nature of wheat production is commercial, 0 subsistence	0.4833	0.5018
Membership	= 1 if member in agricultural cooperatives or farmer groups, 0 otherwise	0.5416	0.5003
Contact	= 1 if regular contact with extension workers, 0 otherwise	0.200	0.4016
Farm size	Wheat cultivation (kattha)	17.3625	16.6489
Experience	Farming experience (year)	20.9416	12.2812
Input market	= 1 if access to input market, 0 otherwise	0.8166	0.3885
Credit	= 1 if access to credit, 0 otherwise	0.8083	0.3952
Irrigation	= 1 if access to irrigation, 0 otherwise	0.5666	0.4976
Subsidy	= 1 if access to subsidy, 0 otherwise	0.1916	0.3952
Output market	= 1 if access to output market, 0 otherwise	0.5166	0.5018

### Determinants of adoption of improved wheat varieties

Table 2 presents the probit and marginal effect for determinants of adoption of improved wheat varieties. The model is highly significant ( $\text{Prob} > \chi^2 = 0.0000$ ) and explains a substantial portion of the variation in adoption ( $\text{pseudo } R^2 = 0.6685$ ). The LR  $\chi^2(15) = 91.66$  and log-likelihood =  $-22.7264$  indicate a good model fit and reliable estimates. Overall, these results suggest that socio-economic, institutional, and resource-related factors are important determinants of farmers' adoption decisions.

Gender had a positive and statistically significant effect ( $p < 0.05$ ). The marginal effect evaluated at the mean (MEM) indicates a strong positive influence of being male on the likelihood of adoption, suggesting that male-headed households are more likely to adopt improved wheat varieties compared to female-headed households, holding other factors at their mean values. This finding aligns with the Theory of Planned Behavior (TPB), where perceived behavioral control, often shaped by access to resources and decision-making power, plays a crucial role in adoption decisions. Male farmers typically have greater control over productive resources and social networks, enhancing their ability to adopt innovations. This finding is consistent with Abda (2022), which reported that male-headed households were more likely to adopt improved varieties due to better access to resources and social networks.

Education had a statistically significant negative effect ( $p < 0.05$ ). The marginal effect at the mean suggests that higher levels of education are associated with a lower likelihood of adoption, holding other variables constant at their mean values. Although this result contrasts with conventional expectations, it can be interpreted through the TPB framework, where more educated individuals may develop attitudes favoring off-farm opportunities, thereby reducing their intention to adopt agricultural innovations. From a diffusion perspective, educated farmers may also critically evaluate the relative advantage of local improved varieties compared to alternative options. This finding aligns with previous studies (Subedi et al., 2019a; Ullah et al., 2022). Formal education increases human capital, often shifting focus toward off-farm employment, which may reduce engagement in agricultural innovation (Mishra et al., 2023; Subedi et al., 2019a). Additionally, more educated farmers may recognize the cost and market advantages of alternative varieties, including those from neighboring regions.

Nature of production had a statistically significant positive effect ( $p < 0.10$ ). The marginal effect at the mean indicates that commercially oriented farmers are more likely to adopt improved wheat varieties compared to subsistence-oriented farmers. This supports Rogers' Diffusion of Innovation theory, as commercially oriented farmers are more likely to perceive improved varieties as offering greater relative advantage in terms of productivity and income generation. This finding is consistent with previous studies (Begho, 2022; Kendall et al., 2022; Ruzzante et al., 2021), which reported that commercial farmers have better access to formal seed sources, a higher willingness to invest in productivity-enhancing technologies, and a stronger orientation toward income stability.

Input market access had a statistically significant positive effect ( $p < 0.01$ ). The marginal effect at the mean indicates a strong positive association between access to input markets and the likelihood of adoption. This suggests that, for a representative farmer, access to input markets substantially increases the predicted probability of adopting improved wheat varieties. However, this effect should be interpreted as a local effect evaluated at the mean of covariates rather than a uniform change across all observations. The strong magnitude reflects the critical role of input availability in reducing uncertainty and enabling adoption decisions. This finding is consistent with previous studies (Awotide et al., 2016; Ghimire et al., 2015), which reported that adoption increases with improved access to seeds and other agricultural inputs.

Output market access had a statistically significant negative effect ( $p < 0.05$ ). The marginal effect at the mean suggests that access to output markets is associated with a lower likelihood of adopting improved wheat varieties. This negative relationship indicates that market incentives influence farmers' varietal choices, consistent with the compatibility dimension of the Diffusion of Innovation theory. Farmers with better market access may prefer varieties that align with cross-border demand rather than officially recommended improved varieties. This is particularly relevant in the context of the open border with India, where farmers may cultivate varieties that fetch higher demand in external markets. Similar findings were reported by Adeleke et al. (2024), highlighting the role of output markets in shaping varietal adoption decisions. This also reflects limitations in domestic market incentives relative to broader regional market opportunities.

**Table 2. Probit model estimation on determinants of adoption of improved wheat varieties**

Variables	Coef.	Std. Err.	p-value	dy/dx	Std. Err. (dy/dx)
Gender	1.8900**	0.8117	0.020	0.4837	0.2114
Age	-0.0618	0.0465	0.184	-0.0097	0.0075
Education	-0.1704**	0.0808	0.035	-0.0268	0.0157
Off-farm income	-0.5900	0.5360	0.271	-0.0998	0.0939
Log(income)	-0.2173	0.6380	0.733	-0.0342	0.1003
Production	1.3037*	0.7645	0.088	0.2112	0.1435
Membership	0.7056	0.5558	0.204	0.1176	0.0997
Contact	0.2726	0.8133	0.737	0.0384	0.1007
Farm size	0.0259	0.0319	0.417	0.0040	0.0047
Experience	0.0051	0.0420	0.902	0.0008	0.0066
Input market	3.9416***	0.8232	0.000	0.9497	0.0522
Credit	0.1095	0.8450	0.897	0.0181	0.1439
Irrigation	0.6639	0.5008	0.185	0.1126	0.1015
Subsidy	0.9188	1.0205	0.368	0.1001	0.0763
Output market	-2.6141**	1.1477	0.023	-0.4574	0.1814
_cons	1.2498	4.1288	0.762		
Summary statistics					
Number of observations =120					
Prob > chi <sup>2</sup> = 0.0000					
Pseudo R <sup>2</sup> = 0.6685					
LR chi <sup>2</sup> (15) = 91.66					
Log likelihood = -22.7264					
Mean VIF = 2.34					

Note: \*, \*\*, \*\*\* indicate significant at 10%, 5%, 1% level of significance, respectively.

### Adoption status of improved wheat varieties

Table 3 presents different varieties of improved wheat adopted by farmers, along with their adoption period and the area under cultivation (kattha). The results show that varieties such as Banganga and Aditya have been adopted only for a short time (1-2 years and 2-3 years, respectively), and are cultivated on relatively small areas of 2-9 and 4-8 kattha, respectively. In contrast, varieties such as Vijay and Bhrikuti have been adopted for a longer period (1-10 years) and are cultivated on much larger areas (2-70 kattha and 5-80 kattha, respectively), reflecting their long-standing presence and acceptance among the farming community. Similarly, the wheat varieties Zinc-1 and Zinc-2 are also cultivated on larger areas (up to 70 kattha), indicating their high level of adoption among farmers. Other varieties such as Gautam and NL-varieties have been in use for 1-7 and 1-9 years, respectively, and are cultivated on a medium scale. Result is similar to the findings of previous studies (Bhatta et al., 2022; Rokaya & Pandey, 2025; Subedi et al., 2019a, b).

**Table 3. Improved wheat varieties: Adoption year and cultivation area**

Variety	Year of adoption (years)	Area under cultivation (kattha)
Aditya	2 - 3	4 – 8
Banganga	1 - 2	2 – 9
Gautam	1 - 7	7 – 30
NL varieties	1 - 9	5 – 20
Vijay	1 - 10	2 – 70
Bhrikuti	1 - 10	5 – 80
Zinc varieties	1 - 3	2 – 70

### Reasons for the non-adoption of improved wheat varieties

Table 4 presents the reasons why some farmers are not adopting improved wheat varieties. Not knowing the benefits of these improved varieties appears to be the major reason, with the highest frequency count (13). The second most common reason is the high cost of seeds (12), followed by limited knowledge about the production practices of improved seeds (10) and limited institutional support (10). Additionally, unavailability of seeds when needed (4) and concerns about adaptability (1) were also noted as reasons for non-adoption.

**Table 4. Reasons for the non-adoption of improved wheat varieties**

Reasons	Frequency (n=31)
Unfamiliarity with benefits	13
High cost of seeds	12
Limited knowledge about production practices	10
Limited institutional support	10
Concerns about adaptability	1
Unavailability of seeds	4

Note: Multiple responses were allowed, so the sum of frequencies exceeds the number of respondents.

### Reasons for adopting improved wheat varieties

Table 5 presents the reasons why farmers are adopting improved wheat varieties. The main reason, with the highest frequency count, is that these varieties give higher yields (58). The second most common reason is better grain quality (48), followed by their capacity to withstand diseases and pests (25) and shorter growing periods (9). Additionally, factors such as better market prices (2), and seed availability and government support (3) were also noted as reasons for adopting improved wheat varieties. Result is in line with Bhatt et al. (2020), which reported yield, grain quality and disease-pest resistance as major preferred traits.

**Table 5. Reasons for adopting improved wheat varieties**

Reasons	Frequency (n=89)
High yield	58
Improved grain quality	48
Better resistance to diseases/pests	25
Shorter growing period	9
Better market price	2
Other (seed availability, government support)	3

Note: Multiple responses were allowed, so the sum of frequencies exceeds the number of respondents.

### Challenges faced while adopting improved wheat varieties

Table 6 presents the major challenges faced by farmers while adopting improved wheat varieties. Based on frequency count, the major challenge seems to be poor access to inputs, such as fertilizer and irrigation, reported by 70 respondents. Without adequate fertilizer or irrigation, farmers cannot obtain the full benefits of improved wheat varieties. The second common challenge is lack of detailed information on improved varieties (55), indicating that many farmers lack the technical knowledge to cultivate improved wheat varieties. Similarly, the high cost of seeds (26) is a significant constraint, as some cannot afford to purchase seeds every year, limiting adoption. Another issue is the limited availability of seeds (14). Result is similar to the findings of previous studies (Bhatta et al., 2022; Devkota et al., 2020; Poudel et al., 2021; Rokaya & Pandey, 2025; Subedi et al., 2019a, b).

**Table 6. Challenges faced while adopting improved wheat varieties**

Challenges	Frequency (n=89)
Poor access to inputs (fertilizer/irrigation)	70
Lack of detailed information	55
High cost of seeds	26
Limited availability of seeds	14

Note: Multiple responses were allowed, so the sum of frequencies exceeds the number of respondents.

### Information sources on improved wheat varieties

Table 7 presents the different sources of information that farmers who adopted primarily used to get information about improved wheat varieties. Based on frequency counts, the most common source was fellow farmers (36), followed by farmer groups or cooperatives (28), extension workers (13), agrovet shops (6), and ICT (6). Previous studies (Mishra & Bhatta, 2021; Mishra & Singh, 2025; Niraula et al., 2023) also reported similar information sources among farmers.

**Table 7. Information sources on improved wheat varieties (among adopters)**

Information sources	Frequency (n=89)
Fellow farmers	36
Farmer groups/cooperatives	28
Extension workers	13
Agrovet	6
ICT (Information and Communication Technology)	6

### Desired support for adoption of improved varieties

Table 8 presents the different measures desired by farmers to increase the adoption of improved wheat varieties. Based on frequency counts, the major support desired by farmers was availability of resources (47), which they believed would help increase adoption by ensuring better access to essential inputs such as quality seeds, fertilizers, and irrigation facilities. Furthermore, farmers desired subsidies (45), indicating that reducing the costs of seeds and other inputs is essential for promoting adoption. Technical assistance (28), such as training and guidance, was also in demand, as farmers stated it would help ensure the proper use of improved varieties.

**Table 8. Desired support to increase adoption of improved varieties**

Measures	Frequency (n=120)
Resources availability	47
Subsidies	45
Technical assistance	28

### Perceptions regarding improved varieties by farmers

Table 9 presents the perceptions of farmers regarding improved wheat varieties. Most farmers had a positive perception of these varieties. Based on frequency counts, the majority (85) believed that improved wheat yields more than other types of wheat varieties. Similarly, most farmers (84) agreed that it is more resistant to diseases and pests, and the majority (88) felt that it is more palatable.

**Table 9. Perception regarding improved varieties by farmers**

Statement	Response	Frequency (n=120)
Improved wheat varieties yields more	Yes	85
	No / Same or Less	35
Improved wheat varieties is more resistant	Yes	84
	No / Same or Less	36
Improved wheat varieties is more palatable	Yes	88
	No / Same or Less	32

### CONCLUSION

The results revealed that adoption of improved wheat varieties is positively affected by male-headed households, commercial nature of production, and access to input markets. Similarly, negative association was observed with education and access to output markets. Vijay and Bhrikuti varieties were adopted for longer periods and in comparatively larger areas. Non-adoption of improved varieties was mainly due to unfamiliarity with benefits and high seed costs. While, adoption was driven by higher yield, better grain quality, and disease/pest resistance. The major challenges reported during adoption included limited access to fertilizers and irrigation, and insufficient technical knowledge on production package. Fellow farmers and farmer groups or cooperatives were the main sources of information on improved varieties, and farmers expressed positive perceptions on yield, grain quality and disease/pest resistance about improved varieties. Desired support on resources and subsidies were reported to improve the adoption of improved varieties. Hence, to accelerate the adoption of improved varieties, it is recommended that strengthening access to input markets and fostering a shift toward commercial-oriented production systems are crucial. Further, to promote adoption, access to quality inputs should be improved, technical training should be provided, farmer groups and cooperatives should be strengthened, awareness of improved varieties should be promoted, subsidies should be offered, and market linkages should be developed.

Overall, the findings demonstrate that both diffusion-related factors (such as access to information and input markets) and behavioral factors (such as perceptions, attitudes, and resource control) jointly influence adoption decisions. This supports the complementary use of Diffusion of Innovation and Theory of Planned Behavior in explaining agricultural technology adoption in developing country contexts.

### AUTHOR CONTRIBUTIONS

**AA:** Conceptualization, Validation, Formal analysis, Investigation, Data curation, Visualization, Writing – original draft; **SB:** Writing – original draft, Writing – review & editing; **BPM:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization.

### CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### ETHICAL APPROVAL AND PERMITS

Ethical approval for this study was obtained from the Institutional Review Board of Nepal Polytechnic Institute, Purbanchal University, Nepal. All participants were informed about the objectives of the study, assured of confidentiality, and provided written informed consent prior to participation.

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