

## RESEARCH ARTICLE

## GENDER PERSPECTIVES ON THE ADOPTION AND IMPACT OF MINI-TILLERS IN THE HILLY REGIONS OF PALPA, NEPAL

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## ARTICLE DETAILS

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## ABSTRACT

This study assessed mini-tiller adoption in Palpa's vegetable sub-sector, focusing on gender differences. A total of 60 households, including 35 adopters and 25 non-adopters, were surveyed using a simple random sampling method with a semi-structured questionnaire. Descriptive and inferential statistics were analyzed using MS Excel and the Statistical Package for Social Science (SPSS) program (Version 25.0). Farmers' perceptions of production and marketing issues were ranked using a forced ranking scale, while a binary logit model was employed to identify factors influencing mini-tiller adoption. The study revealed that male-headed households were more likely to adopt mini-tillers (91.4%) than female-headed ones (8.6%). Subsidy (88.6%) and training (71.4%) played crucial roles in adoption at 1% and 5% significance levels, respectively. Decision-making in adopter households was predominantly male-led, especially regarding training participation (88.6%) and mini-tiller adoption (91.4%). Male adopters had greater access to land ownership (82.9%) and mechanization training (92%), both significant at 1% and 5% levels. Post-adoption effects included time savings (RII = 0.8) and increased efficiency per unit land (RII = 0.785). The major barriers for non-adopters were accessibility to heavy tractors (RII = 0.9167) for males and difficulty handling mini-tillers (RII = 0.7692) for females. The adoption model indicated that subsidy ( $p < 0.01$ ), landholding ( $p < 0.10$ ), and occupation in agriculture positively influenced adoption, while farming experience had a negative impact ( $p < 0.05$ ). These findings highlight the role of financial incentives, training, and gender dynamics in agricultural mechanization adoption. These findings can be used by policy makers, practitioners, PMAMP and concerned stakeholders to promote gender-inclusive programs, addressing post-adoption barriers, and accelerate agriculture mechanization.

## KEYWORDS

Adoption, Agriculture, Mini-tiller, Technology, Women

## 1. INTRODUCTION

Agriculture is the mainstay of Nepal's economy, contributing 24.1 % to the national Gross Domestic Product (GDP) and engaging around 57.3 % of the population in agricultural activities as their primary income source, with female participation (64.8%) surpassing male participation (50.6%) (AICC, 2024). The Agriculture Development Strategy (ADS), a long-term policy framework for agricultural transformation in Nepal (2015-2035), aims to enhance food self-sufficiency and reduce poverty through commercialization (MOALD, 2024). However, achieving these goals is challenging without widespread agricultural mechanization.

Agricultural mechanization plays a crucial role in addressing labor shortages, reduce drudgeries, and enhance efficiency and profitability (Kienzle et al., 2013). Mechanization can contribute significantly to the national economy by improving productivity. Gender, referring to the socially constructed characteristics, roles, behaviors, and norms associated with women, men, girls, and boys, as well as their relationships, plays a vital role in agricultural mechanization, influencing access to resources and decision-making (WHO, 2018). Despite its significance, empirical research exploring the relationship between gender and agricultural mechanization remains limited. In Nepal, gender roles were not formally acknowledged by policymakers until the publication of "Rural Women of Nepal" (Bennett et al., 1989).

Global data indicates that women make up approximately 43% of the

agricultural workforce, with a similar trend observed in developing nations (Sharma, 2018). For centuries, women have played a crucial role in agriculture in these regions. However, they often face marginalization and limited access to essential resources such as land, information, markets, education, extension services, and agricultural credit. This lack of access hinders their ability to adopt new agricultural technologies, including mechanization. Factors such as male outmigration and the shift of men towards non-agricultural sectors have led to the increasing participation of women in farming, particularly in rural areas (Leduc, 2011). While this trend has created more employment opportunities for women, it has also increased their workload. Given this situation, the adoption of mechanization is crucial for advancing the agricultural sector and reducing the burden on women farmers.

In Nepal, women have always been integral to agriculture. Over the past decade, their role has expanded further as a growing number of men migrate to cities or seek employment abroad, leading to a shift in responsibilities within the rural workforce (FAO, 2019). According to World Bank (2018), approximately 70% of Nepal's population relies on agriculture for their livelihood. Women make up about 80.1% of the agricultural workforce, primarily engaged in low-income subsistence farming, whereas 59.4% of men are involved in the sector. In 2023, Nepal ranked 126th out of 193 countries on the Gender Inequality Index, with a rating of 0.495 (UNDP, 2023). Discrimination against women in the development and dissemination of agricultural technology has significant negative consequences, leading to inefficient resource utilization and

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lower agricultural productivity, as women struggle to adopt improved technologies (Matata et al., 2010). Additionally, many agricultural machines require substantial physical effort, which can be a challenge for women with lower physical strength. To address these issues, gender-sensitive agricultural mechanization is essential to reduce women's workload and ensure they can fully benefit from modern technologies.

Prime Minister Agriculture Modernization Project (2016) aims to boost agricultural production and productivity (PMAMP, 2075). To support this, it is essential to explore the link between gender and agricultural mechanization in potential districts. This study offers unique insights into gender and agricultural mechanization, focusing on mini-tiller adoption in Palpa district, Nepal. Mini-tillers were chosen due to their simplicity and lighter design, which are more commonly adopted by farmers in Palpa compared to heavier machinery (Khanal, 2020). The study assesses the gender dynamics of mini-tiller adoption among vegetable farmers and

identifies the socio-demographic factors influencing adoption, as well as the impact on gender roles post-adoption.

## 2. MATERIALS AND METHODS

### 2.1 Study area

Bagnaskali (1 ward) rural municipality and Tansen (7,8,9 wards) municipality were selected for this study at Palpa as these areas are the highly potential command area of Prime Minister Agriculture Mechanization Project (PMAMP) where various agriculture mechanization programs are being implemented by its Project Implementation Unit (PIU) under the vegetable zone. Besides, Agriculture Knowledge Center, Palpa is also implementing various pockets, blocks, and other programs in these areas (Figure 1).

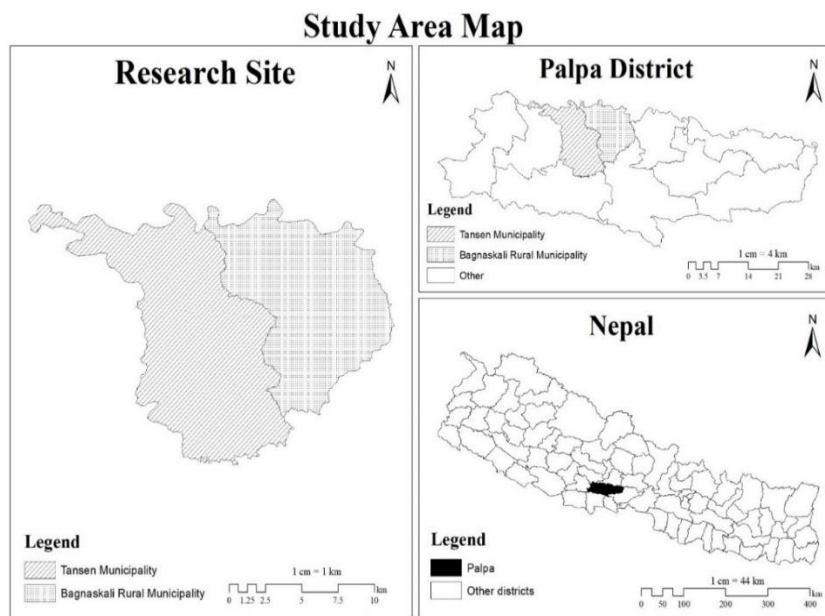


Figure 1: Study site: Palpa (Source: GIS mapping)

### 2.2 Sampling Procedure and sampling size

A sample size of 60 is generally regarded as the minimum requirement for a larger population that will yield a sufficient level of certainty for decision-making in (Poate and Daplyn, 1993; Mari, 2009). A total of 60 farmers were selected from two local levels (Bagnaskali and Tansen) based on simple random sampling and interviewed using the semi-structured type of questionnaire considering the purpose of the study as well as the availability of resources and time frame of the study.

### 2.3 Research Instruments

Preliminary Field Visits, Pre-testing of interview questionnaires, Household interview / Field survey, Key informant interview (KII), and Focus group discussion (FGD) were done and information obtained was used in preparing questionnaires and designing a sampling framework. Data were obtained from primary sources such as field surveys, KII, etc., and secondary sources such as journals, research articles, and proceedings of various NGOs, INGOs, etc.

### 2.4 Survey Design and data collection

An interview schedule was prepared to collect primary information from representative farmers. A coordination scheme was prepared consistent with the objectives of the study, to help and facilitate the interview schedule preparation. Pre-testing of the interview schedule was done by administering the designed interview schedule to the five households around the study area. The final interview schedule was prepared by taking due consideration of the suggestion obtained during the pre-testing.

### 2.5 Data Analysis Technique

The data were coded, entered, and analyzed using MS Excel and Statistical Package for Social Science (SPSS) program (Version 25.0). Descriptive statistics/inferential statistics and econometric analysis were used for the empirical estimation of objectives. The chi-square test was used to study

the association between two variables.

#### 2.5.1 Forced Ranking/Scale of Importance

Farmer's perceptions towards the production and marketing problems were ranked by a six-point scale using scores; 1, 0.835, 0.668, 0.501, 0.334, and 0.167 where 1 indicated most serious and 0.17 indicated least serious. The index was computed using the formula given below:

$$I_{imp.} = \frac{\sum S_i F_i}{N}$$

Where,

$I_{imp.}$  = index of importance

$\sum$  = summation

$S_i$  =  $i^{th}$  scale value

$F_i$  = frequency of  $i^{th}$  importance given by the respondents

$N$  = total number of respondents

#### 2.5.2 Binary logit model

This model was used to determine the factors that influence the adoption of mini-tiller. The dependent variable for this study was the adoption of a mini-tiller with a value of 0 (if the farmer is an adopter) and/or 1 (if non-adopter). The independent variables with their values are shown in Table 1. This model predicts the logit of the dependent variable (adoption of mini-tiller) from the independent variable(s).

The likelihood of the farmer being an adopter is predicted by odds ( $Y = 0$ ); that is, the ratio of the probability that  $Y = 0$  to the probability that  $Y \neq 0$ :

$$\text{Odd } Y = P(Y = 0) / (1 - P(Y = 1)) \tag{1}$$

The binary logit regression model is specified as follows:

The logit ( $Y$ ) is given by the natural log of Odds:

$$\ln [p(Y_i = 0)/(1-p(Y_i = 0))] = \log \text{Odds} = \text{Logit} (Y) \tag{2}$$

$$\text{This can be expanded as } \text{Logit} (Y) = \alpha + \sum \beta_1 X_1 + \sum \beta_2 X_2 + \dots + \sum \beta_n X_n + \epsilon_i \tag{3}$$

Where,

Y = dependent variable (adopter) with 0 = adopter and 1 = non-adopter

$\alpha$  = intercept

$\epsilon_i$  = error index

$\beta_1, \dots, \beta_n$  = coefficients of the independent variables

$X_1, \dots, X_n$  = the independent variables

P (p) = probability of being adopter

1-P = probability that a farmer is non-adopter

ln = natural log

**Table 1:** Dependent and independent variables for the binary logit model

Variables	Types	Value
<b>Dependent variable(Y)</b>		
Adoption of Mini-tiller	Dummy	1 if adopter, 0 if non-adopter
<b>Independent variables</b>		
Landholding(X1)	Continuous	Hectare
Farming experience(X2)	Continuous	Years
Major occupation of household(X3)	Dummy	1 if agriculture, 0 if non-agriculture
Received training related to mini-tiller(X4)	Dummy	1 if yes, 0 if no
Received subsidy on Mini-tiller(X5)	Dummy	1 if yes, 0 if no
Gender of HH(X6)	Dummy	1 if male, 0 if female

### 3. RESULTS AND DISCUSSION

#### 3.1 Socio-economic and demographic characteristics of the respondents

Family size in adopter households (5.37) was found to be significantly higher as compared to non-adopter farmers (4.76) at a 10% level of significance (Table 2). The experience of the adopter (11.49 years) was

found to be significantly lower than non-adopter farmers (16 years) at a 5% level of significance. Farmers with fewer years of experience and large landholding have been found to adopt the mini-tiller mostly. This result contradicts the finding of (Khanal (2020). The average landholding was found to be 0.81 ha which was larger than the national average landholding size of 0.55 ha (CBS, 2023). The average land holding of the adopter (0.95) was found significantly higher than the non-adopter (0.62) household at a 10% level of significance.

**Table 2:** Socio-economic and demographic characteristics (continuous variables) of the respondents based on adoption status

Variables	Adopters (n=35)	Non-adopters(n=25)	Overall (N=60)	Mean difference	t-value	p-value
Age(years)	47.06(10.660)	46.44(7.906)	46.80(9.543)	0.617	0.245	0.807
Family size	5.37(1.416)	4.76(1.300)	5.12(1.391)	0.611	1.705*	0.093
Male No.	2.77(1.031)	2.56(1.003)	2.68(1.017)	0.211	0.792	0.432
Female No.	2.60(0.736)	2.28(0.843)	2.47(0.791)	0.320	1.563	0.123
Economically active members	2.46(1.010)	2.36(1.036)	2.42(1.013)	0.097	0.363	0.718
Dependency ratio	1.52(1.138)	1.29(0.916)	1.43(1.049)	0.229	0.833	0.408
Farming experience	11.49(7.905)	16.00(8.145)	13.37(8.248)	-4.514	-2.154**	0.035
Total land holding	0.95(0.742)	0.62(0.452)	0.81(0.653)	0.326	1.948*	0.056

Note: Figures in parentheses resemble standard deviation to their respective columns. \*\*and \* indicate level of significance at 5% and 10% level of significance respectively.

Table 3 shows that the gender of HH was found to have a significant relationship with adoption status at a 5 percent level of significance. The majority of the household heads were male and mostly male-headed

household has been found to adopt mini-tiller in the studied area. The subsidy and training received in mini-tiller were found to affect adopters significantly at 1 and 5 percent levels of significance respectively.

**Table 3:** Socio-economic and demographic characteristics (categorical variables) of the respondents based on adoption status

Variables	Adopters (n=35)	Non-adopters (n=25)	Overall (N=60)	Chi-square value
<b>Gender of HH</b>				
Male	32(91.4)	18(72)	50(83.3)	3.963**
Female	3(8.6)	7(28)	10(16.7)	
<b>Major occupation</b>				
Agriculture	19(58.3)	12(48)	31(51.7)	1.587
Private jobs	4(11.4)	3(12)	7(11.7)	
Government jobs	5(14.3)	2(8)	7(11.7)	
Foreign employment	5(14.3)	5(20)	10(16.7)	
Business	2(1.7)	3(12)	5(8.2)	
<b>Education qualification</b>				

<b>Table 3 (cont): Socio-economic and demographic characteristics (categorical variables) of the respondents based on adoption status</b>				
Illiterate	1(2.8)	0(0)	1(1.7)	
Below SEE	10(28.6)	6(24)	16(26.7)	
SEE	10(28.6)	9(36)	19(31.7)	
Intermediate	8(22.8)	8(32)	16(26.7)	5.540
Graduation	3(8.6)	1(4)	4(6.7)	
Post-graduation	3(8.6)	0(0)	3(4.8)	
Other technical qualification	0(0)	1(4)	1(1.7)	
<b>Ethnicity</b>				
Brahmin/Chhetri	26(74.4)	23(92)	49(81.6)	
Janajati	8(22.8)	2(8)	10(16.7)	3.206
Dalit	1(2.8)	0(0)	1(1.7)	
<b>Received subsidy on mini-tiller</b>				
Received	31(88.6)	0(0)	31(51.7)	45.813***
Not received	4(11.4)	25(100)	29(48.3)	
<b>Received training on mini-tiller</b>				
Received	25(71.4)	17(68)	42(70)	4.89**
Not received	10(28.6)	8(32)	18(30)	

Note: Figures in parentheses resemble the percentage of the total in their respective columns. \*\* and \*\*\* indicate levels of significance at 5% and 1% respectively.

### 3.2 Decision-making power

The decision made by males related to who attend training related to agriculture was found significantly higher in adopter (88.6%) than in non-

adopter (64%) households at a 5% level of significance (Table 4). The decision related to mini-tiller adoption by mostly males was significantly higher in adopter (91.4%) than non-adopter (76%) households at a 10% level of significance.

<b>Table 4: Decision-making power among gender related to various agriculture-related activities</b>				
Variables	Adopters (n=35)	Non-adopters (n=25)	Overall (N=60)	Chi-square
<b>Decision related to who attends the training related to agriculture</b>				
Mostly male	31(88.6)	16(64)	47(78.3)	5.188**
Mostly female	4(11.4)	9(36)	13(21.7)	
<b>Decision on adoption of Mini-tiller</b>				
Mostly male	32(91.4)	19(76)	51(85)	2.723*
Mostly female	3(8.6)	6(24)	9(15)	
<b>Decision of selling agriculture produced</b>				
Mostly male	31(88.6)	18(72)	49(81.7)	2675
Mostly female	4(11.4)	7(28)	11(18.3)	
<b>Decision on starting agriculture in commercial ways</b>				
Mostly male	31(88.6)	19(76)	50(83.3)	2.675
Mostly female	4(11.4)	6(24)	10(16.7)	
<b>Decision of income earned from selling agricultural produce</b>				
Mostly male	23(65.7)	15(60)	38(63.3)	0.205
Mostly female	12(34.3)	10(40)	22(36.7)	

Note: Figures in parentheses resemble the percentage of the total in their respective columns. \*\* and \* indicates level of significance at 5% and 10% level of significance respectively

### 3.3 Access to various agriculture-related activities

Mostly males were found to have access to agriculture-related activities such as land ownership, finance loan, training related to mechanization (mini tiller), and first-hand information related to agriculture whereas females have more access to cooperative loans. Mostly males who adopt mini tiller were found to have such activities but in case of females who

were non-adopters were found to have access to such activities except in land ownership. Mostly males were found to have access to in participating the training related to mini-tiller. This result was similar to the finding of (Koirala et al., 2015). The access to land ownership and training related to mechanization (mini tiller) were found to be significant with adoption status at 1% and 5% level of significance (Table 5).

<b>Table 5: Access to agriculture-related activities based on gender</b>				
Variables	Adopters(n)	Non-adopter (n)	Overall(N)	Chi-square
Land ownership	n=35	n=25	N=60	

Table 5 (cont): Access to agriculture-related activities based on gender				
Male	29(82.9)	12(48)	41(68.3)	
Female	4(11.4)	2(8)	6(10)	12.630***
Both	2(5.7)	11(44)	13(21.7)	
<b>Access to finance loan</b>	n=12	n=15	N=27	
Male	11(91.7)	10(66.7)	21(77.8)	
Female	0(0)	3(20)	3(11.1)	3.086
Both	1(8.3)	2(13.3)	3(11.1)	
<b>Access to cooperative loan</b>	n=13	n=9	N=22	
Male	6(46.2)	2(22.2)	8(36.4)	
Female	6(46.2)	7(77.8)	13(59.1)	2.43
Both	1(7.6)	0(0)	1(4.5)	
<b>Access to training related to mechanization (mini-tiller)</b>	n=25	n=17	N=42	
Male	23(92)	11(64.7)	34(81)	
Female	0(0)	0(0)	0(0)	4.889**
Both	2(8)	6(35.3)	8(19)	
<b>Access to participation in capacity building program</b>	n=28	n=18	N=46	
Male	13(46.4)	4(22.2)	17(37)	
Female	6(21.4)	8(44.4)	14(30.4)	3.649
Both	9(32.2)	6(33.4)	15(32.6)	
<b>Access to first-hand information related to agriculture</b>	n=31	n=21	N=52	
Male	19(61.3)	8(38.1)	27(51.9)	
Female	7(22.6)	8(38.1)	15(28.8)	2.726
Both	5(16.1)	5(23.8)	10(19.3)	

Note: Figures in parentheses resemble the percentage of the total in their respective columns. \*\*\* and \*\* indicate level of significance at 1% and 5% level of significance respectively.

### 3.4 Effect after the adoption of mini-tiller

The Likert technique is used to rank the main effects following the adoption of the mini-tiller along with their index values (Table 6). Since only adopters provided feedback on the effects of adoption, and since

there were a total of 35 adopters, 35 were taken into account when calculating rank. The results showed that time savings for Palpa's vegetable growers were the most significant result of the mini-tiller's adoption.

Table 6: Effect after the adoption of mini-tiller								
Questions	Intensity					Total	Relative Importance Index (RII)	Rank
	Highly agree (2)	Agreed (1)	Neutral (0)	Disagree (-1)	Highly disagree (-2)			
Increased vegetable cultivated land area	23	0	0	3	9	35	0.357	VI
Decreased number of laborers	16	9	1	3	6	35	0.371	V
Time saved	23	10	2	0	0	35	0.8	I
Increased efficiency per unit ropani	23	11	0	0	1	35	0.785	II
Increased productivity per unit ropani	10	18	3	4	0	35	0.485	IV
Change in working hours	8	2	3	9	13	35	-0.242	VII
Change in gender role	3	7	1	7	17	35	-0.4	VIII
Workload reduction	16	13	1	3	2	35	0.542	III

Note- the negative "-" sign denotes there was the least effect

### 3.5 Increment in Female adoption of Mini-tiller

The major factors for the increase in female adoption of mini-tiller with their index value are ranked using the forced ranking method (Table 7).

The findings indicated that low-power mini-tillers were the most significant factor in encouraging mini-tillers adoption among Palpa's female vegetable farmers.

Table 7: Increment in women's adoption of mini-tiller		
Questions	Index value	Rank
Low power mini-tiller	0.801	I

Table 7 (cont): Increment in women's adoption of mini-tiller		
Light weight mini-tiller	0.775	II
Formal education	0.322	V
Skill enhancing training	0.725	III
Access to Capital	0.306	VI
Increased subsidy rate	0.573	IV

### 3.6 Ways to bring gender equity among vegetable farmers

Education is regarded as the most important factor by 16.3 percent of respondents to bring gender equity among vegetable farmers (Figure 2).

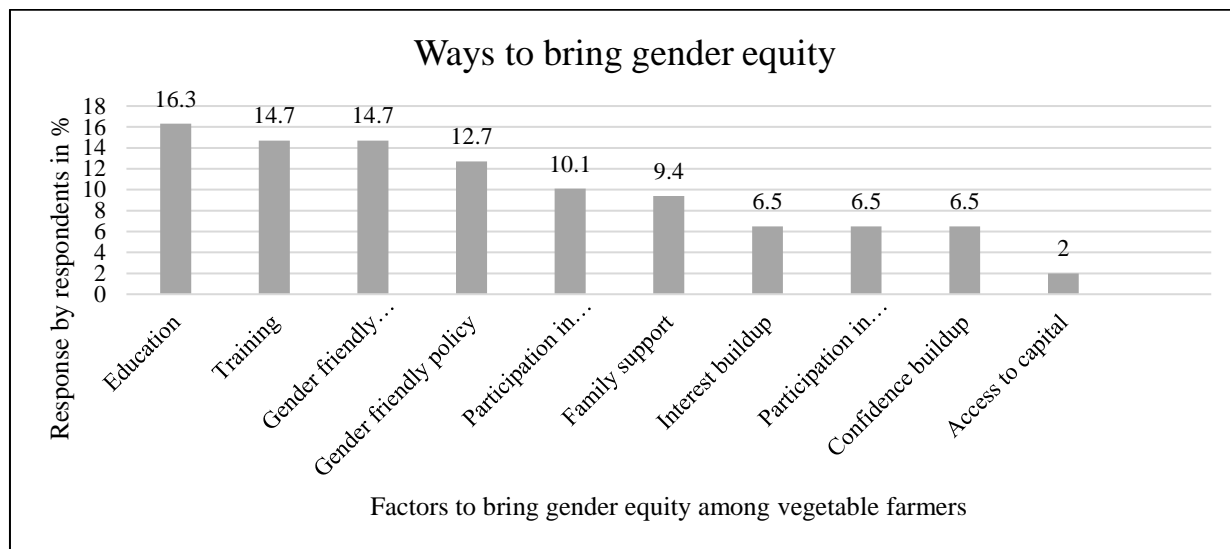


Figure 2: Ways to bring gender equity among vegetable farmers

### 3.7 Satisfaction

The respondents' stated levels of satisfaction for different categories

were graded differently for males and females (Table 8). Both male and female respondents reported being most satisfied with mini-tiller subsidies.

Table 8: Rank based on satisfaction level				
Questions	Male		Female	
	Relative Importance Index	Rank	Relative Importance Index	Rank
Subsidy on Mini-tiller	0.513	I	0.310	I
Subsidy rate	0.090	II	0.048	II
Service by extension agent	-0.154	IV	-0.309	V
Training	-0.167	V	-0.167	IV
Programs conducted	0.051	III	-0.095	III

Note: the negative “-” sign denotes dissatisfaction.

### 3.8 Reasons for not adopting Mini-tiller

Male and female respondents from non-adopter households provided reasons for not adopting mini-tillers, and those reasons were ranked (Male and female respondents from non-adopter households provided

reasons for not adopting mini-tillers, and those reasons were ranked (Table 9). According to the male respondent, the main reason for not adopting a mini-tiller was that the land is accessible to heavy tractors, but the female respondent stated difficulty in handling due to land orientation and intense handle vibration.

Table 9: Reasons for not adopting mini-tiller				
Reasons	Male		Female	
	Relative Importance Index	Rank	Relative Importance Index	Rank
Lack of skill	-0.25	V	0.5769	II
Intense handle vibration	-375	VI	0.7692	I
Difficult to handle due to land orientation	0.0416	III	0.7692	I
Lack of initial capital	0.4167	II	0.4615	IV
Accessible area to heavy tractor	0.9167	I	0.5	III
No subsidy granted	-0.0833	IV	0.0384	V

Note: the negative “-” sign denotes dissatisfaction.

### 3.9 Factors influencing the adoption of mini-tiller

The Chi-square goodness-of-fit test statistics were used to explore the major factors that influence farmers' decisions to adopt mini-tiller. This showed that the model fits the data at the 1% significance level and the independent variables were relevant in explaining the farmers' decision to adopt a mini-tiller. About 76.7% of the overall sample cases were correctly predicted by the model. Out of six explanatory variables included in the model, four were found to be significant in influencing the farmers' decision to adopt or not to adopt mini-tiller (Table 10).

Receiving of subsidy has a positive influence on the adoption of mini-tiller at a 1% statistical significance level. The result shows that farmers who have received the subsidy for mini-tiller have adopted mini-tillers more as compared with those who have not received them. The odd ratio indicated in the model concerning receiving of subsidy implies that another thing being held constant, the odds ratio in favor of adopting mini-tiller technology increases by a factor of 8.545 units as subsidy received increases by 1 unit. The result suggested that receiving of subsidy has a positive influence on the farmer's user decision and adoption of mini-tiller. This result is similar to the result of in the respective studies (Khanal, 2020). The subsidy provided ranges from 50-75%. The farmers are found more satisfied with the subsidy rate of 75%.

Farming experience has a negative influence on the adoption of mini-tiller at a 5% statistical significance level. The result shows that farmers who have more experience in farming tend to adopt mini-tiller less compared

with those who have less experience. The odd ratio indicated in the model about farming experience implies that another thing being held constant, the odds ratio in favor of adopting mini-tiller technology decreases by a factor of 0.932 units as farming experience increases by 1 unit.

The adoption of the mini-tiller is positively impacted by total land holding at the 10% level of significance. The result suggests that smaller landholders have adopted mini-tillers more often than larger landholders. The odds ratio for adopting mini-tiller technology grows by a factor of 46.7 units when land holding increases by one unit, according to the odd ratio shown in the model about total land holding, with other things being held constant. The favorable outcome could be that farmers with large land holdings tend to employ heavy tractors for farming because they believe them to be more effective than mini-tillers. This result contradicts the finding of (Khanal, 2020) in the respective studies.

Agriculture as the major occupation of households also has a positive influence on the adoption of mini-tiller significantly at a 10% level of significance. The result implies that households with agriculture as a major occupation tend to adopt mini-tiller more than non-agricultural occupations. The odd ratio indicated in the model about major occupation implies that another thing being held constant, the odds ratio in favor of adopting mini-tiller technology increases by a factor of 3.258 units as agriculture as major occupation increases by 1 unit which indicates that farmers who have major occupation as agriculture cultivate the land all around year requiring mini-tiller for increased efficiency thus increasing adoption of mini-tiller.

**Table 10:** Factors influencing the adoption of mini-tiller

Determinants	B	SE	P value	Wald ratio	Exp(B)
Gender of HH (1=male, 0=female)	0.781	1.832	0.67	0.182	2.813
Total land holding(ha)	3.864*	1.208	0.082	10.034	46.797
Farming experience(year)	-0.710**	0.035	0.043	1.108	0.932
Major occupation of household Agriculture	1.181*	0.707	0.095	2.794	3.258
Received training related to mini-tiller (1=yes, 0=no)	2.371	0.826	0.374	8.239	6.437
Received subsidy on mini-tiller (1=yes, 0=no)	2.145***	0.784	0.006	7.485	8.545
Constant	-4.281**	1.729	0.013	6.128	0.014
$\chi^2$ value	22.210***				
-2 log-likelihood	57.67				
Overall model prediction	76.70%				

Note: \*\*\*, \*\*, and \* indicates level of significance at 1%, 5%, and 10% level of significance respectively.

### 4. CONCLUSION

The study found that mini-tiller adoption was higher among male-headed households, especially those with larger landholdings and families but less farming experience. Subsidies and training played key roles, though access to both was mostly limited to men. Adopters, mostly male, had greater access to land ownership, finance, and mechanization training. Mini-tiller adoption significantly saved time, reduced labor needs, and increased efficiency, with lighter, low-power models boosting female adoption. Education was seen as key to gender equity in farming. Subsidies were the most satisfying aspect for both genders, while non-adopters cited accessibility to heavy tractors and difficulty handling the mini-tiller as barriers. Agriculture as the main occupation, land ownership, and subsidies positively influenced adoption, while farming experience had a negative effect. The primary benefit was time savings, followed by increased efficiency per ropani, with minimal impact on gender roles. Subsidizing low-horsepower mini-tillers has been effective for vegetable farmers. While PMAMP and other agencies have boosted adoption through subsidies and training, more gender-inclusive training is needed. The government and stakeholders should implement gender-sensitive strategies and capacity-building programs to enhance mechanization benefits.

### CONFLICT OF INTEREST

We declare to have no conflicts of interest.

### AUTHOR'S CONTRIBUTIONS

Sneha Sapkota: Conceptualization, Methodology, Data curation, Formal analysis, Visualization, Writing - original draft, Writing - review & editing. Srijana Shrestha: Conceptualization, Methodology, Visualization, Writing - review & editing.

Ajay Kumar Yadav: Conceptualization, Methodology, Writing - review & editing.

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