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Agricultural Mechanization and its Problems in Gauradaha Municipality of Jhapa District, Nepal

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HIGHLIGHTS

- Agriculture mechanization can lower costs, workloads and operating times
- Cultivars and Threshers were the most popular and widely used farm machines
- Large-sized farm holders and commercial farmers adopt farm mechanisation

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ABSTRACT

Mechanisation can lower labour costs, workloads, and operating times, which eventually boosts agricultural productivity and output. The study aimed to assess the status of mechanisation, problems of adoption of mechanisation, and its impact was conducted during 2024-25. Purposive random sampling of 120 farmers from four wards of the Gauradaha municipality of Jhapa was used and collected data on socio-economic status, problems, and the impact of farm mechanisation. Chi-square test was used to determine the relationship between selected variables. This study suggested that 100% farmers used cultivators and threshers, followed by 79.17% pump sets/motor, 55% combine harvester, 42.5% Reaper and 11.7% others (Power tiller, Corn sheller, Corn harvester, Driller, Paddy straw cutter). Subsidy to buy farm machinery was obtained by 10% of farmers only. Larger holdings of farmers' land had a positive significance in the use and adoption of farm mechanisation.

INTRODUCTION

Agricultural mechanisation (AM) involves using tools and machinery to optimize production at any stage. Its primary goal is resource efficiency, which generates significant socio-economic benefits for farmers (Emani et al., 2008; GC et al., 2009). Mechanization can lower labour costs, workloads, and operating time, which eventually boosts agricultural productivity and output (Paudel et al., 2019; Daum & Birner, 2020). For every 1% increase in the levels of mechanization, the yields of all crops, grain crops, and cash crops increase by 1.215, 1.594, and 0.435%, respectively (Peng et al., 2022). Effective mechanization offers significant resource efficiency, potentially reducing seed use by 15–20%, fertiliser by 20–30%, and labour by 5–20%, while boosting productivity by up to 20% (Singh, 2008; Tiwari et al., 2019; Mehta et al., 2023). However, Nepal's mechanization rate remains low at 20-25 %, trailing significantly behind global leaders like the US (95%), Russia (80%), and China (48%) (Mehta et al., 2023; Baruah et al., 2025).

Most of farmers in Nepal are small-sized farm holders with an average of 0.8 hectares (Gauchan & Shrestha, 2017) that forces them to practice subsistence farming and lesser adoption of farm mechanisms. Adopting farm machinery is also hampered by farmers' poor financial circumstances (Uchelegit et al., 2020). Most of Nepal's farm power requirements are met by human (40.5%) and animal (36.3%) power, with mechanical power making up a meager 23.2% of the total (Ranabhat et al., 2025). This indicates that mechanization in the country is still in its infancy (Shrestha, 2012).

Agricultural mechanization should contribute to a sustainable increase in productivity and cropping intensity so that the planned

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growth rates in agricultural production are achieved (Mehta et al., 2014). The lack of agricultural labour and their increased daily wage have resulted in the demand for agricultural mechanization in Nepal. Hence, the migration of youth can be regarded as a major driver for the increasing demand for agricultural mechanization (Shrestha, 2022). Only over one-fifth of the power utilized in Nepal is thought to be used by machines (Shrestha, 2012). Approximately 90% of the mechanical power in use today is concentrated in Terai that is accessible to the market. Due to the challenges of moving large machinery and utilizing it on narrow terraces, mechanization is minimal in the hilly and mountainous regions. However, the employment of tractors, power tillers, pump sets, and threshers has increased recently due to increased road connectivity in rural hills and mountains. Shrestha (2012) also reported lack of well-defined policy regarding agricultural mechanization has resulted in a lack of efficiency in meeting the needs of farming communities and national development objectives related to the commercialization of agriculture in Nepal. Previous researcher Shrestha (2022); Ranabhat et al. (2025) etc have emphasized policy over the first-hand perspectives and perceptions of farmers regarding mechanization. So, objectives of this research were to explore status of farm mechanism, impact and problems associated with adoption of farm mechanism.

METHODOLOGY

Gauradaha Municipality of Jhapa was selected for this study as represented in Figure 1. Four wards were selected purposely for survey purposes. These wards were selected due to the availability of roads and accessibility of the agriculture service centre. Besides, farmers cultivate a diverse range of crops such as rice, wheat, maize, and cash crops like tea, and jute. This variety offers a broad perspective on the implementation of agricultural mechanization.

Purposive random sampling was used for data collection. Inclusion criteria of farmers in this study that farmers have at least 0.8 hectare of land for agricultural purposes. Ward number 1,2,3, and 4 were selected and equal number of samples were collected. Altogether 120 samples were taken by using Slovin's Formula ($n=N/1+Ne^2$, where N is population size) was used for sample size estimation. This study used a descriptive sample survey research approach to learn about how farmers use different farm machinery. Quantitative data were used to assess the status of farm mechanization. Information on mechanization was collected through a structured survey questionnaire. Before performing the survey, the interview schedule was checked to ensure its clarity, reliability and validity. 5% of the total respondents were interviewed for pre-testing, just to reduce the chances of mistakes. After the pretesting, some adjustment was done. Then the interview was conducted at the convenient places of farmers, such as their home, field, and their store. And the interview was conducted in an interpersonal way of communication. The raw data was recorded and stored in mWater application. Data were coded, tabulated, and analyzed using both descriptive and inferential statistics. Descriptive tools, such as frequency and percentage, were employed to examine respondents' socio-economic characteristics (age, gender, religion, ethnicity, and education). Additionally, a Chi-square test was used to determine the relationships between dependent and independent variables. The gathered information was entered and analysed by using tools like Word, excel, and *IBM SPSS Statistics V21.0*.

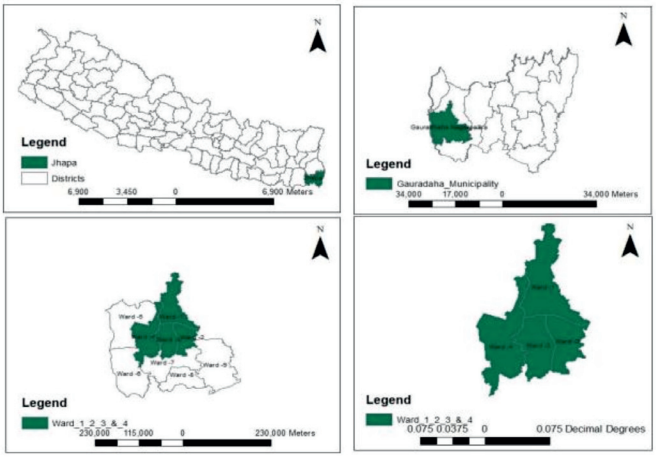

Figure 1. Administrative map of Gauradaha municipality, ward number 1,2,3 and 4

RESULTS

Farm machinery used, subsidy and ranking of farm machines

Importance of machineries

Findings of the study reveal that 43% of farmers used farm machineries to increase production, productivity, and profitability; 36% farmers used it to minimize human labor, and 21% for the timeliness of operation (Figure 2).

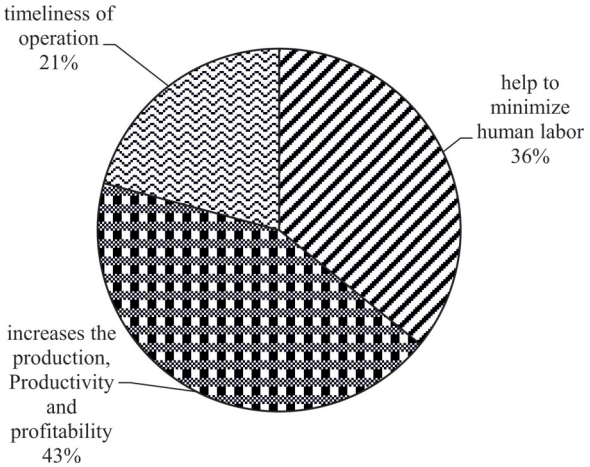

Figure 2. Importance of Machineries

Use of different farm machineries

Cultivator and thresher were most popular used by 100% of respondents while, 79.17% used pump sets or motor for watering the field, 55% used combine harvester, 42.5% used reaper for harvesting paddy and 11.7% used other types of machinery which include corn sheller, corn harvester, power tiller, driller and paddy straw cutter.

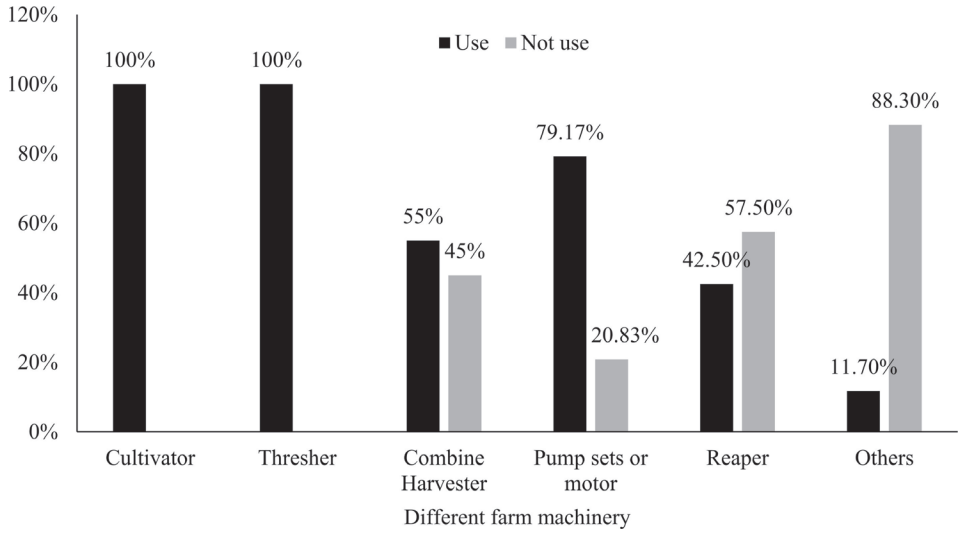

Figure 3. Use of different farm machinery

Machines availability

Around 96% of farmers opted to rent machinery for their agricultural operations. Only 3.33% purchased machinery independently, and a mere 0.83% received partial funding from government subsidies (Figure 4). This highlights a critical gap in governmental support for the adoption of farm machinery, which remains in its early stages.

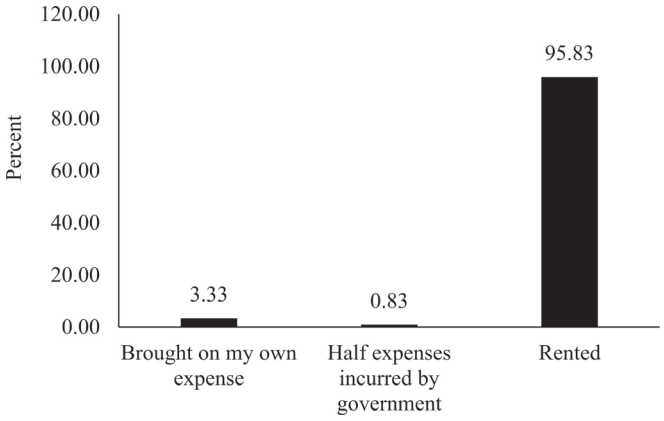

Figure 4. Machines availability

Subsidy to buy new machines

Findings of the study reveal that government subsidy reached only 10% of farmers to buy farm machinery as shown in Figure 5. High initial cost is reported as one major hinderance in adoption of farm machinery. And without subsidy, farmers in general are simply not capable of owing or renting on higher cost.

Subsidy provision

Among the 10% farmers who received subsidy 10% farmers received from their own municipality (local government) only about one percentage farmer received it from cooperatives (Table 1). 50% subsidy was provided to farmers for the purchase of machinery such as pump sets, Power tiller, driller etc. Majority of farmers received subsidy for the purchase of pump sets.

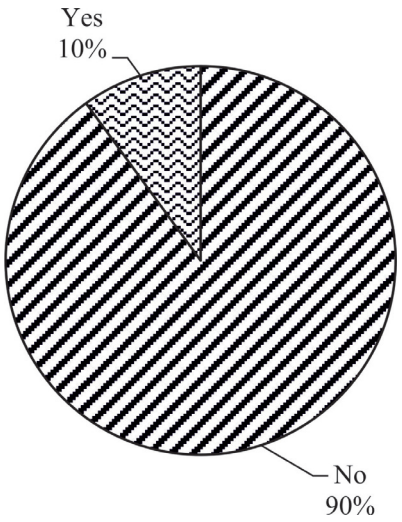

Figure 5. Subsidy received for machine purchase
Source: Field survey, 2024

Table 1. Provision of 50% subsidy

Category	Percent
Cooperatives	1%
Municipality	9 %

Source: Field survey, 2024

Rank of machineries

The survey results highlight the cultivator and thresher as the most essential tools, ranked by over 98% of respondents. The Cultivator is the top preference, with 55.46% ranking it first, while the Thresher's utility is distributed more evenly across the second to fourth positions. The combine harvester (ranked by 55%) also shows strong primary importance, with over half of its users (51.51%) placing it in the top spot. In contrast, pump sets (48.33%) and reapers (42.5%) are primarily viewed as secondary or tertiary tools. The motor (15%) and "Others" (13.33%) saw the lowest engagement, with the latter almost exclusively relegated to the fifth position or lower (Table 2).

Table 2. Rank of different machineries

Types of Machines	Ranking					Total	Overall
	1	2	3	4	5 or more		Rank
Combine Harvester	51.51%	19.69%	27.27%	0%	1.51%	55%	III
Cultivator	55.46%	32.77%	9.24%	4.20%	1.68%	98.17%	I
Motor	5.55%	0%	38.88%	38.88%	16.66%	15%	VI
Pump sets	24%	31%	1.72%	32.75%	10.34%	48.33%	IV
Thresher	5.08%	30.5%	27.11%	28.81%	8.47%	98.33%	II
Reaper	1.96%	55%	37.25%	17.64%	17,64%	42.5%	V
Others	0%	0%	0%	12.5%	87.5%	13.33%	VII

Source: Field survey, 2024

Farm mechanization and its relation to farm size, land holding, income

Relationship between farm mechanization with farm size and duration

The correlation analysis reveals a positive relationship between mechanization year, farm size, and technology adoption, with stronger effects observed as duration and size increase as shown in Table 3. While the early years of mechanization (1–5 years) showed a non-significant correlation ($r = 0.39$), prolonged engagement of more than five years resulted in a strong and highly significant positive association with technology adoption ($r = 0.67^{**}$, $p < 0.01$). Furthermore, farm size significantly influenced adoption patterns; although both smallholders (< 0.3 ha) and commercial farmers (> 1 ha) exhibited significant positive correlations, the strength of the relationship was notably higher for commercial operations ($r = 0.61^{*}$, $p < 0.05$) compared to small-scale farms ($r = 0.34$, $p < 0.05$).

Table 3. Pearson correlation between mechanization duration and farm size to mechanization

Mechanization year	(Pearson correlation r)
1-5 years	0.09 ns
>5yrs	0.67**
Small farmers (< 0.3 ha)	0.34*
Commercial farmers (>1 ha)	0.61*

*,** significant at 0.05 and 0.01 level of significance

Factors affecting adoption of Farm mechanization

Chi- square test was used for association between categories of land and different machines used in agriculture at 5% level of significance. There was significant association between land holdings and combine harvester (i.e., p-value= 0.000<0.05), there was significant association between land holdings and pump sets/motor (i.e., p-value=0.000<0.05) as shown in Table 4. There was insignificant difference between land holdings and Reaper (i.e., p-value=0.252>0.05). There was significant difference between land holdings and other types of machineries such as power tiller, driller, corn harvester, corn sheller etc. The larger the land of farmers of any level, the chances of adopting and using different machinery seem to prosper. So, size of land holding was found to have significant over use of different farm machineries.

Table 4. Relation between total cultivated land and use of farm machinery

Different Machineries	p-value
Combine Harvester	0.000
Pump sets or motor	0.000
Reaper	0.252
Others	0.020

Source: Field survey, 2024

Chi-square test was used for association between Annual Income and different machines used in agriculture at 5% level of significance. There was insignificant association between annual income and combine harvester (i.e., 0.58>0.05) as shown in Table 5. There was insignificant association between annual income and pump sets /motor (i.e., 0.640>0.05). There was significant association between annual income and reaper (i.e., 0.000<0.05) again there was insignificant association between annual income and other types of machineries such as power tiller, driller, corn sheller, corn harvester (i.e., 0.447>0.05).

Low-income farmers cannot afford a custom hiring centre. Survey results revealed that low and medium income is a non-significant association with custom hiring, as shown in table 6). Despite the Custom Hiring Centre rendering services at a fair price, our farmers are too poor to afford those. This clearly indicates that our farmers simply cannot afford the cost rates of machineries. positive correlation ($r = 0.44^{*}$) indicates that the use of custom hiring centres is primarily affordable for commercialised farmers.

Problems of mechanization

Research shows that 32% of farmers reported maintenance and repair cost of machine is the primary obstacle to adopting farm mechanization, 26% noting high initial costs and lack of technical knowledge, 14% referencing inadequate infrastructure, and 2% concerned about frequent maintenance and repair challenges (Table 7).

Farmers perception

Cost of machines

Among farmers, a significant 59.17% feel that rental costs are too high, while 40.83% believe they are quite reasonable as shown in Table 8. Most farmers, 65%, get information about agricultural machinery from family and friends. Meanwhile, 19.17% rely on

Table 5. Relation between annual income and use of farm machinery

Different machineries	Status	2-5 lakhs	5-10 lakhs	<2 lakhs	>10 lakhs	P-Value
Combine harvester	Yes	19.7%	36.4%	3%	40.9%	0.58
	No	27.8%	35.2%	13%	24.1%	
Pump sets/Motor	Yes	21.1%	36.8%	8.4%	33.7%	0.640
	No	32%	32%	4%	32%	
Reaper	Yes	13.7%	39.2%	0%	47.1%	0.000
	No	30.4%	33.3%	13%	23.2%	
Others	Yes	21.4%	35.7%	0%	42.9%	0.447
	No	23.6%	35.8%	8.5%	32.1%	

Source: Field survey, 2024

Table 6. Relation between the annual income of farmers and their access to the custom hiring centre

Annual income	Pearson correlation (r)
Low income (less than 5 lakh)	0.09 ns
Medium income (5-10 Lakh)	0.29 ns
High income (> 10 lakh)	0.44*

ns=non-significant, * significant at 5 * level

Table 7. Major problems in the adoption of farm mechanization

	Percent	Rank
Frequent maintenance and repair	32%	I
High initial cost	26%	II
Lack of infrastructure	14%	IV
Lack of technical knowledge	26%	III
Others	2%	V

Table 8. Farmers perception towards cost of machines

Variable	Category	Percent
Do you think rental cost is high?	No	40.83
	Yes	59.17
Where do you get the information about machineries?	Agri-vet	19.17
	Family/Friends	65
	Neighbors	15
	Social media	0.83
Are the machines easily available to purchase?	No	25
	Yes	75
What is your opinion in the price of machineries?	Moderately expensive	45.83
	Very expensive	54.17

Source: Field survey, 2024

Agri-vets, 15% consult neighbors, and just 0.85% use social media. 75%of respondents believe that agricultural machines are easily accessible, while 25% think they are not.65% of farmers consider the price of machinery to be very expensive, while 55% view it as moderately expensive.

Mechanization impact

Research shows that 75% of farmers experienced a significant increase in productivity, while 23.33% saw moderate improvements (Table 9). However, 1.67% reported no change in their productivity. Kandel et al. (2021) reported that the implementation of farm mechanisation has a positive impact on maize production and productivity. According to a survey, farm mechanisation

Table 9. Farmers' perception of the impact of mechanization

	Category	Percent
Mechanization on Productivity	Significantly increased	75.00
	Moderately increased	23.33
	No change	1.67
Mechanization on labor requirements	Reduced labor significantly	64.17
	Reduced laborModerately	35.00
	No change	0.83
Mechanization on income	Significantly increased	75.83
	Moderately increased	23.33
	No change	0.83
Is mechanization essential for future farming in Nepal?	Strongly agree	66.67
	Agree	32.50
	Neutral	0.83

Source: Field survey, 2024

significantly reduces labor for 64.17%, while 42% see a moderate reduction. In contrast, only 0.83% believe there is no effect on labor requirements.75.83% of farmers experienced a significant boost in income, while 23.33% saw a moderate increase. Only 0.3% reported no change in their income. 66.67% of farmers strongly affirm that mechanisation is crucial for the future of farming in our country, while 32.5% agree. In contrast, just 0.83% feel that mechanisation has no role to play.

DISCUSSION

In Nepal, the majority of farmers are small-scale holders working on highly fragmented land. This fragmentation serves as a significant barrier to farm mechanization. Consequently, many farmers still rely on traditional hand tools such as spades, khurpis, and sickles, or small-scale equipment like MB ploughs and mini-tractors. According to Takeshima & Liu (2020), farm sizes smaller than 0.5 hectares significantly lower the adoption rate of modern machinery. In the Terai and other plain regions, the use of modern machinery including tractors for tillage and various harvesters is becoming essential. Farmers' most preferred farm operation for mechanization were irrigation, milling, plant protection, threshing and land preparation (Baruah et al., 2025). Due to the high labour demands of cultivation and harvesting, the cultivator and thresher have become the most common and popular machines among all farmers (Kandel et al., 2021; Ranabhat et al., 2025). Butter et al. (2025) also reported that majority of farmers preferred farm mechanization because of high labour cost. The threshing operations

trend can be linked to the limited availability of labour, coupled with higher labour wages, encouraging farmers to opt for tractor-mounted threshers. These machines are not only cost-effective but also reduce drudgery and save time compared to manual threshing or the use of draught animals (Raina et al., 2021).

Because of the high costs associated with purchasing equipment, most farmers prefer to rent machinery rather than own it (Ranabhat et al., 2025). Cooperatives play a vital role in this ecosystem by facilitating machine rentals, which directly increases the adoption of farm technology (Atinafu et al., 2022). To further encourage mechanization, cooperatives, Agriculture Service Centres, and other organizations provide critical support. Research by Atinafu et al. (2022) and Dhakal et al. (2024) highlights that partial or full subsidies provided by the government and farmer groups are essential for the successful adoption and purchase of new agricultural machinery which are accordance to our findings.

CONCLUSION

Farm mechanization is well adopted for tillage as well as harvesting. Cultivator and thresher were used by 100% of respondents. Likewise, most farmers used water pumps or motors, combine harvesters, reapers, and other machinery such as power tillers, drillers, corn shellers, corn harvesters, and paddy straw cutters respectively. Land holdings present a significant challenge for local farmers; 41.67% possess less than 10 kattha of land, a constraint that hinders their capacity to utilize machinery effectively. Around 96% of farmers opted to rent machinery for their agricultural operations. Survey revealed that only 10% of farmers received government subsidies to invest in machinery. High initial costs are a major barrier to adopting modern equipment. Without sufficient subsidies, many farmers struggle to afford to buy or rent the machinery they need. This highlights the need for greater government support and resources to help farmers embrace mechanization.

DECLARATIONS

Ethics approval and informed consent: Ethical approval was not required for this study. All authors concur with the submission, and informed consent was sought and received from all respondents

Conflict of interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. The author declares that they have thoroughly reviewed, revised, and edited the content as needed. The authors take full responsibility for the final content of this publication.

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REFERENCES

Atinafu, A., Lejebo, A., & Alemu, A. (2022). Adoption of improved wheat production technology in Gorche district, Ethiopia. *Agriculture & Food Security*, *11*(1), 1-8. https://doi.org/10.1186/s40066-021-00343-4

Baruah, M., Barman, S., & Rahman, A. (2025). Farm mechanization and farmers' preferences: evidence from north bank plain zone of Assam. *Indian Journal of Extension Education*, *61*(3), 37-41.

Buttar, G. S., Sodhi, G. P. S., Manes, G. S., Sunidhi, Kaur, T., Brar, N. S., & Kaur, S. (2023). Adoption pattern of farm-machinery-based solutions for in-situ paddy straw management in Punjab. *Indian Journal of Extension Education*, *59*(4), 103–108.

Dhakal, S., Pandey, S., Chapagain, S., Devkota, Y., Sunar, M., & Khanal, S. (2024). Factors affecting the adoption of farm mechanization in Rupandehi, Nepal. *Archives of Agriculture and Environmental Science*, *9*(3), 409-413, https://dx.doi.org/10.26832/24566632.2024.090301

Gauchan, D., & Shrestha, S. (2017). Agricultural and rural mechanization in Nepal: status, issues and options for future. *Institute for Inclusive Finance and Development*. https://cgspace.cgiar.org/handle/10568/87968

GC, A., Yeo, J.-H., & Ghimire, K. (2019). Determinants of Farm Mechanization in Nepal. *Turkish Journal of Agriculture- Food Science and Technology* https://www.agrifoodscience.com/index.php/TURJAF/article/view/2131

Kandel, S., Poudel, R., Saru, M. T., & Parajuli, T. (2021). Status of farm mechanization and its impact on maize production in Jhapa District, Nepal. *Archives of Agriculture and Environmental Science*, *6*(3), 290-294.

Mehta, C. R., Chandel, N. S., & Senthilkumar, T. (2014). Status, challenges and strategies for farm mechanization in India. *Agricultural Mechanization in Asia, Africa and Latin America*, *45*(4), 43-50.

MoALD, (2023). *Statistical Information on Nepalese Agriculture 2021/22*. Singhadurbar, Kathmandu: Government of Nepal.

Paudel, G. P., KC Dilli Bahadur, Rahut Dil Bahadur, Justice, S. E., & McDonald, A. J. (2019). Scale-appropriate mechanization impacts on productivity among smallholders: Evidence from rice systems in the mid-hills of Nepal. *Land Use Policy*, 104-115. doi: 10.1016/j.landusepol.2019.03.030

Raina, A., Thakur, R., & Kumar, S. (2021). Extent and impact of farm mechanization in hilly state of Himachal Pradesh. *Indian Journal of Extension Education*, *57*(1), 61–66.

Ranabhat, S., Bastola, A., Shrestha, A., & Tiwari, N. (2025). Farm mechanization and factors affecting its adoption among wheat growing farmers in Rupandehi, Nepal. *Nepal Agriculture Research Journal*, *16*(1), 43-53. https://doi.org/10.3126/narj.v16i1.80449

Shrestha, S. (2012). Status of agricultural mechanization in Nepal. *United Nations Asian and Pacific Center for Agricultural Engineering and Machinery (UNAPCAEM)*. https://www.un-csam.org/sites/default/files/2021-01/np_1.pdf

Takeshima, H., & Liu, Y. (2020). Smallholder mechanization induced by yield-enhancing biological technologies: Evidence from Nepal and Ghana. *Agricultural Systems*, *184*, 1-10. https://doi.org/10.1016/j.agsy.2020.102914