

Does joint land ownership empower rural women socio-economically? Evidence from Eastern Nepal

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ABSTRACT

Joint Land Ownership (JLO) is increasingly important for empowering women and improving their socioeconomic well-being. However, there is a lack of empirical research on this topic. Utilizing panel data from 2015 to 2020 and employing the Binary Logit Model, this study examines the socioeconomic and empowerment status of rural women who have JLO in the Sunsari district of Nepal. Particularly, we used a quasi-experimental research design and pretest and posttest research models to assess the empowerment status of rural women before and after the implementation of JLO. The results indicate a significant increase in monthly savings (270%) among women who have a JLO, as well as improved access to credit (241%), income (87%), participation in cooperatives (69%), entrepreneurship (56%), decision-making (56%), occupation (22%), and overall improvement in their socioeconomic conditions (16%). The women's participation in the JLO program also has increased by 77% in rural areas and 23% in urban areas. Furthermore, logistic regression results show that Rural Women Empowerment (RWE), resulting from JLO, varies significantly across different ethnic groups ($\beta = -0.724$, $P < 0.01$), land sizes ($\beta = 0.117$, $P < 0.01$), household sizes ($\beta = 0.886$, $P < 0.01$), household decision-making ($\beta = -1.814$, $P < 0.05$), and occupations ($\beta = -0.868$, $P < 0.01$). Our findings suggest that JLO significantly impacts rural women's empowerment, gender equality, and overall development, thereby assisting in the achievement of several UN Sustainable Development Goals. It emphasizes the need for policy interventions, legal reforms, and awareness-raising efforts to promote and support JLO to empower women and promote inclusive and sustainable rural development.

1. Introduction

In societies worldwide, women contribute significantly but often face marginalization in roles like household chores and agricultural labor, especially in rural areas (Cai et al., 2020). Global statistics reflect this disparity, with women contributing a substantial portion of agricultural labor, yet bearing the burden of unpaid care and domestic work (UN

Women, 2015; Chatterjee and Laban, 2014). This inequity highlights the importance of gender equality, emphasized in Sustainable Development Goals like SDG5 (Ferrant et al., 2014). Gender disparities in land ownership, seen in places like rural Albania and Nepal, stem from cultural norms and legal gaps, necessitating comprehensive approaches combining legal education, gender awareness, and poverty alleviation to empower women economically (Zhllima et al., 2023; CSRC, 2020;

Abbreviations: B/A, Before and After; CBS, Central Bureau of Statistics; CDS, College of Development Studies; CSRC, Community Self-reliance Centre; DLR, District Land Right Forum; DLRO, District Land Revenue Office; GoN, Government of Nepal; INGOs, International Non-Governmental Organizations; ILC, International Land Coalition; IV, Independent Variable; JLO, Joint Land Ownership; MoLCPA, Ministry of Land Management, Cooperative and, Poverty Alleviation; NGOs, Non-Governmental Organizations; NLR, National Land Rights Forum; NOU, Nepal Open University; NPC, National Planning Commission; RWE, Rural Women Empowerment; STATA, Statistical Software; VLRF, Village Land Right Forum; WDR, World Development Report.

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Pradhan, 2018; Cush et al., 2018). These patriarchal norms often restrict women's access to land ownership and decision-making, impacting their empowerment and societal status (Malhotra et al., 2002; Chakrabarti and Biswas, 2012; Khanal et al., 2020; Akram, 2018).

Rural women's empowerment hinges on several socioeconomic factors that measure their agency and progress (Kurzman et al., 2019; Venugopalan et al., 2021). These factors include income generation, savings, entrepreneurship, decision-making within households, property control, participation, and land ownership (O'Sullivan, 2017). Unfortunately, in many developing countries, these factors remain largely male-dominated due to societal norms (Shabaya and Konda-Agyemang, 2004; Warnecke, 2013). Cultural constraints often limit women's effective control over legally owned property (Ossome, 2014; Kang et al., 2019). Yet, women's land ownership significantly contributes to their empowerment and socioeconomic well-being (Allendorf, 2007; Chigbu, 2019; Ali et al., 2016), enabling decision-making in crucial aspects of life (Lord and Hutchison, 1993). Prioritizing rural women's access to land and assets is vital for fostering empowerment and sustainable rural development (Smith, 2018; World Bank, 2019). This empowerment involves enhancing women's capacities to impact institutions affecting their lives (Dabissa, 2013), linking women to societal dignity and fostering innovation for a robust and healthy society (Khanal et al., 2023; Shabana et al., 2017).

The JLO initiative, promoted by the International Land Coalition (ILC) across 30 + developing nations, aims to foster equality in land ownership between spouses, advancing harmonious relationships and women's empowerment. Despite women representing nearly half the global population, they own less than 20% of the land, revealing a gap between legal provisions and practical ownership (Daley et al., 2013; Haub and Kaneda, 2013). Particularly, indigenous women in rural Nepal face significant deprivation in land ownership, job opportunities, and household decision-making power, necessitating empowerment through enhanced resources (Atteraya et al., 2016). A survey by CDS Nepal in 2013 noted that over half of the respondents were indigenous women, highlighting their socio-economic marginalization due to low land ownership and empowerment in the country. Several studies explore the impact of Joint Land Ownership (JLO) on women's empowerment in developing countries like Nicaragua (Merino, 2012), Honduras (Lastarria and Cornhiel, 2003), Indonesia (Lastarria and Cornhiel, 2003), India (Datta (2006); Janssens (2010), Laos (Lastarria-Cornhiel, 2006), Rwanda (Ngango and Hong, 2021), Vietnam (Menon et al., 2014), and Madagascar (Agarwal, 2003). The joint registration of marital properties varies across countries – the highest 57% in Rwanda ((Ngango and Hong, 2021) and the lowest in Mali (7%). Similarly, female-headed households' percentage in JLO varies – the highest in Tanzania (33%) and 10% in Mali, which is the lowest. While progress has been made in some regions, there are still significant disparities and challenges to overcome. Efforts to implement gender-equitable land registration systems and empower women in decision-making processes must continue. By ensuring equal access to land and property rights, societies can foster women's economic empowerment, enhance their social status, and contribute to overall sustainable development.

The JLO policy, launched in 2002 by Nepal's government, addresses gender inequalities in land ownership. It aims to empower women by enabling joint land registration for spouses and promoting equal land rights within a patriarchal society. This policy allows mutual ownership, preventing individual land sales without both spouses' agreement (Koirala, 2022). However, there is a lack of comprehensive studies in Nepal on the socio-economic impact of JLO on rural women's socio-economic and empowerment. Existing research mainly focuses on assessing women's awareness and project implementation, but not the actual impact on empowerment. As the paper Reform, LPR (2007) argued that the lack of rigorous evaluation in property rights interventions extends to women's land ownership, hindering the effectiveness of efforts to secure women's property rights and their impact on gender equality in land ownership and economic empowerment.

Addressing this gap is essential for advancing women's rights and sustainable development. This study examines the socioeconomic status and empowerment of rural women who have JLO in the Sunsari district, located in the eastern part of Nepal. Our findings suggest that JLO has significant implications for rural women's empowerment, gender equality, and overall development. It emphasizes the need for policy interventions, legal reforms, and awareness-raising efforts to promote and support JLO to empower women and promote inclusive and sustainable rural development.

2. Literature review

2.1. JLO practices and its impacts on women's empowerment

The IRC report from 2020 detailed that 37 countries across South Africa and Asia have adopted JLO policies. These nations implementing JLO policies are all classified as developing or least developed countries. Various studies conducted in these developing countries have explored the status of JLO and its effects on empowering women. Table 1 showcases key findings from several of these nations practicing JLO policies.

Numerous studies in developing countries explore Joint Land Ownership (JLO) and its impact on women's empowerment. Notable instances include Nicaragua, where the 1997 Married and Common Law empowered 7.8% of married women for joint land registration. In Honduras, gender equity projects since 2000 resulted in 35% of land

Table 1
Impact of JLO on Women's Empowerment.

Author & Country	Results/ Findings
Merino (2012), Nicaragua	Married women could authorize their land rights through joint land registration (i.e., 7.8% of 2619) after Married and Common Law in 1997.
Datta (2006) Chandigarh, India	Among 203 spouses surveyed, 38% of women jointly owned land, 25% felt respected by their husbands, 65% prevented unilateral JLO land sales by their husbands, and 30% were involved in household decision-making.
Lastarria (2006), Laos	The record of joint land registration for spouses is 7% of total ownership, reaching 41% in urban and 27% in rural in Laos.
Janssens (2010), India	5.7% of women in the 'Mahila Samakhya' empowerment program feel safer taking collective action in India compared to rural women from the poorest lower-caste families.
Burnod et al. (2012), Madagascar	In 1800 households, 6% of marital property plots were jointly registered, and 12% were in the wife's name.
Wiig (2013), Peru	Peru's Land Titling and Cadaster Project showed that among 140,000 titled plots, 37% were jointly titled, with 57% used for agriculture.
Widman and Hart (2019), Madagascar	Only 3% to 4% of land becomes jointly titled in Madagascar.
Newman et al. (2015), Vietnam	Out of 32,436 plots of land, 8.5% of plot land are registered jointly, and 7.3% of plots are used for rice production.
Bayisenge (2018), Rwanda	In Rwanda, married women predominantly own land. Among registered land, spouses jointly own 81%, with wives aged 35-60 owning 33%.
(Cush et al., 2018),	Patriarchal norms in agriculture often limit women's access to land ownership and decision-making in the family.
(Agrawal, 2003), India	Group initiatives promoting joint land ownership in India benefit land reform, community cooperation, and joint farming, particularly empowering poor women.
(Reform, LPR, 2007),	Insufficient evaluation of property rights interventions, especially concerning women's land ownership, hampers efforts to secure their rights and impacts gender equality in land ownership and economic empowerment.
(Zhillima et al., 2023), Albania	A comprehensive strategy blending legal education, gender awareness, and poverty alleviation is essential to boost women's economic involvement.

registered to couples and 21% to women. Indonesia recorded a modest 5% JLO under the 1974 Marriage Law. Chandigarh, India, reported 38% of women owning joint land with positive perceptions. Laos achieved 7% joint land registration, rising to 41% in urban and 27% in rural areas. India's 'Mahila Samakhya' program notably increased women's collective action, with 5.7% feeling safer compared to the poorest rural families (Janssens, 2010).

Similarly, studies on joint registration of marital property reveal varying patterns globally. In Rwanda, 37% of 140,000 titled plots were jointly registered, primarily for agriculture. The Pathways Program noted women's joint land ownership percentages in India (26%), Malawi (41%), Mali (7%), and Tanzania (43%). Vietnam's Land Reform Law facilitated 8.5% of jointly registered land plots. Rwanda showed high joint ownership among married women (81%). However, Madagascar had a low joint land titling rate (3–4%). Initiatives promoting joint land ownership in India could catalyze land reform and empower marginalized women. Ethiopian research on land certification in the Amhara region highlights positive impacts on household trust, especially regarding women's land ownership (Bezabih et al., 2011).

It is noted that the examples from Nicaragua, Honduras, Indonesia, Laos, and India's 'Mahila Samakhya' program showcase diverse outcomes, emphasizing increased empowerment and safety for women. It has a clear policy message that drawing insights from successful models encourages global adoption of Joint Land Ownership (JLO) policies. It is witnessed that incorporating successful models emphasizing gender equity and empowerment initiatives, recognizing diverse patterns, leveraging trust-building from programs like Ethiopia's land certification, and prioritizing joint land ownership for women's empowerment and inclusive land reform, particularly in marginalized communities in India.

While progress has been made in some regions, there are still significant disparities and challenges to overcome. Efforts to implement gender-equitable land registration systems and empower women in decision-making processes must continue. By ensuring equal access to land and property rights, societies can foster women's economic empowerment, enhance their social status, and contribute to overall sustainable development.

The JLO policy, initiated in Nepal in 2011, allows spouses to jointly own land by registering both names with a minimal fee of 100 Nepalese Rupees (equivalent to \$0.76 as of 12/18/2023 exchange rate). This policy offers a 25–50% tax exemption on new joint land registrations, varying by location. The Civil Code of 2017 also supports women in registering land based on income capacity and mutual understanding between spouses. Studies by CDS in 2013 and CSRC in 2021 found significant participation of women in JLO programs. By December 2020, 10,118 couples in 37 districts of Nepal had obtained JLOs on 2779.01 ha. Despite women comprising 51.5% of the population, only 19.71% have ownership of land and buildings, with 52.7% holding less than 0.5 ha of land, indicating a gradual increase in women's property ownership in Nepal (Koirala, S. (2022).

Joint land ownership by spouses can have both positive and negative impacts, especially in the cultural context, legal frameworks, and the specific circumstances of the individuals involved in the context of developing countries (Mishra and Sam, 2016). It's important to note that the specific effects can vary based on the local socio-economic and cultural context. Joint land ownership provides socio-economic security, empowering both spouses with a shared asset for livelihoods and loans (Meinzen-Dick et al., 2019). Particularly impactful for women, it enhances their legal rights, status, and community standing. Collaborative decision-making improves resource utilization and agricultural productivity (Balayar and Mazur, 2021). Overall, it fosters social stability, strengthens family ties, facilitates access to credit, and contributes to rural development through sustainable land use practices and community engagement (Rao, 2017).

However, legal joint ownership doesn't always translate to equal decision-making, as cultural biases may favor male control over land.

Lack of clear guidelines can lead to conflicts, making joint decision-making time-consuming and inefficient (Jain et al., 2023). Spousal mobility may be restricted, and inherited joint ownership can lead to land fragmentation. Unequal access to resources and cultural norms may undermine the practical benefits, especially for women (Jackson, 2003). Despite its several positive aspects, there are several challenges of land tenure practices in Nepal. The Nepali land tenure system is significantly twisted and is utilized to consolidate power. As a result, land ownership has been the most contentious topic in Nepal's political economy during the last fifty years. On the other hand, because the land has been exploited as a political instrument by oligarchic rulers to reward specific strata of society by providing them with reliable income, it has become a continual source of conflict and power conflicts (Schwilch et al., 2017). Although the Civil Code (2017) provides for women's property rights, it contains biases against women's property rights by stressing the rights of the family group to land. Similarly, there is no specific provision for women under directive principles and policies regarding land and property as directed by the constitution (2015). In this context, it is believed that the JLO certificate empowers women, enhancing their self-confidence and participation in family decisions, organizations, and economic activities, and fosters mutual understanding but it is yet to be proved with empirical study.

2.2. JLO practices in Nepal

Over the years, Nepal has witnessed significant milestones in women's land rights. Beginning in 1975 with the amendment of Muluki Ain, ensuring daughters' equal share, progress continued with national conferences, applications for Joint Land Ownership (JLO) policy, and a mass movement in 2009. The culmination was in 2010, with a women's assembly pressuring for land rights, leading to the formation of the Joint Land Certificate policy. The 2015 Constitution explicitly addressed women's land rights. Subsequent developments include the National Reconstruction Authority (NRA) incorporating JLO provisions in 2017 and the implementation of JLO formats and procedures in April 2017. The Civil (Code) Act of 2017 further solidified legal provisions for women's property rights in Nepal. The historical timeline of JLO in Nepal is presented in Table 2.

3. Methods

3.1. Conceptual framework

Various theories have addressed women's empowerment, including Gender Theory (Okin, 2015), Neoclassical Land Reform Theory (Dorner, 1972), Democratic Adaptation Theory of Land (Hornby, Kingwill et al., 2017), Marxism Theory (Engels, 2007), Evolutionary Replacement Theory (Platteau, 1996), and Cadastral/Customary Theory (Hull et al., 2019). Gender Theory emphasizes how gender inequities in developing cultures undermine principles of justice and equality (Okin, 2015). Neoclassical Theory proposes land reform to alleviate poverty, unemployment, and inequality, and establish a strong economy (Zarin and Bujang, 1994). Democratic Adaptation Theory stresses the importance of democracy, gender equality, and accountability in land rights (Hornby et al., 2017). Evolutionary Replacement Theory suggests that population pressure leads to the evolution of individual property rights (Platteau, 1996). Marxism Theory highlights gender hierarchies and the potential of joint property ownership for women's empowerment (Engels, 2007). Cadastral/Customary Theory focuses on restricted decision-making authority and limited land ownership for women (Hull et al., 2019).

This study integrates modified ideas from previous research (Meinzen-Dick et al., 2019; Haque et al., 2011; Dabissa, 2013), as depicted in Fig. 1. The study focuses on rural women empowerment, specifically examining the relationship among factors related to land ownership, demographics, and socio-economic factors before and after the JLO

Table 2
Timeline of History of JLO in Nepal.

Time period	Events	Results
1854 January	Muluki Ain 1854 - the foundational legal text for modern Nepal	Provided for an equal sharing of the property as similar brothers upon reaching the age of 35.
1963 August	Muluki Ain 1963 – First Amendment of Muluki Ain 1854	The daughter who reached the age of 35 was only entitled to half of the land, whereas her brother was entitled to the whole property.
1975 June- July	World Conference on Women, 1975	Post the 1975 International Women’s Conference, Muluki Ain 2020 amended to grant daughters an equal property shares as their brothers if unmarried at 35, while sons gained coparcenary rights in ancestral property by birth.
2005 February	First national women conference in Kathmandu	The inaugural national women’s conference advocated for equal land ownership by pressuring the government for joint land ownership on par with men.
2007 April	Application Submission to MOLRM for JLO policy by women of Sindhupalchok	Sindhupalchok women sought joint land ownership, urging the government through applications to the MOLRM for parity in land rights with men.
2009 March	March pass movement for women land rights by the women of Kailali, Kanchanpur, Dang, Banke and Bardia	Pressure to government for women land ownership
2010 April	Women mass assembled in Kathmandu to pressure the political party from 50 district of Nepal for the women land rights	Joint Land certificate policy formed and come to action from FY 2068/69
2011	Census 2011 reported that female ownership over Land and Buildings	Census shows female ownership of fixed assets at 19.71%, including land or house ownership. In urban areas, it’s 26.77%, while rural areas stand at 18.02% (National Population and Housing Census 2011).
2015 October	Constitution of Nepal 2015 has the provision of women land rights	Nepal’s 2015 Constitution, Article 38, ensures women’s rights. Sub Article (1) guarantees equal lineage rights without gender discrimination, and Sub Article (6) grants spouses equal rights in property and family affairs.
2017 March	National Reconstruction Authority 2017 has the provision of JLO	Under Section 5(3) of its guidelines, the NRA 2017 allows JLO registration through land purchases using compensation provided to households affected by earthquakes.
2017 April	Women land rights forum delegate to MOLRM for the JLO implementation format	JLO procedure requires original ownership certificate, citizenship certs for both spouses, marriage registration if husband’s name isn’t in citizenship, and two photos of the wife (and husband if not in old records), plus land revenue payment receipt. Application needs a joint letter, three generations’ details, and a ten-rupee postage stamp, submitted to the land revenue officer.
17 August, 2018	Nepal formed Civil (Code) Act 2017 as amendment of Muluki Ain 1963 AD	The Civil Code Act 2017 addresses property rights for women. It allows joint property to use for family needs based on earnings and understanding (Sec 90(1)). During partitioning, husband, wife, parents, sons, and daughters are coparceners (Sec 205(1,2,3)). Joint owners cannot alter property status without consensus (Sec 261).
2017 October	The National Civil (Code) Act, 2017	The Civil Code Act 2017, Chapter 10 Sec 90(1), allows joint property of spouses for family management based on income and understanding. Sec 206 considers spouses and family members as coparceners of such joint property.

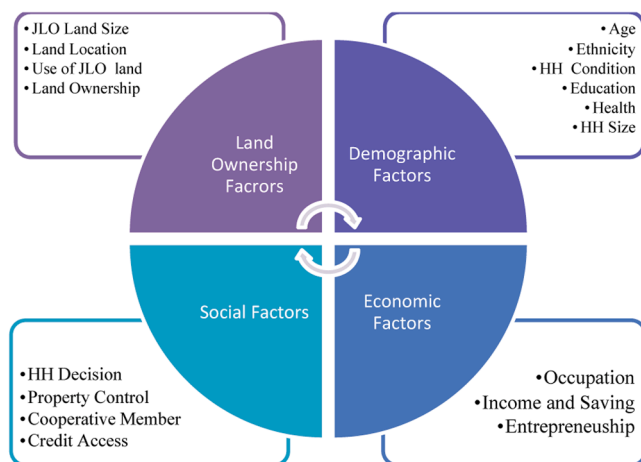


Fig. 1. Conceptual Framework: Adopted and modified from Dibassa (2013), Meinen-Dick et al. (2019) and Haque et al. (2020).

intervention. Demographic characteristics considered in this study include ethnicity and household size of JLO-holding women, which are used to assess their demographic status. The variables indicate that ethnicity groups and household size have both positive and negative associations with rural women’s empowerment through JLO. Land ownership characteristics encompass JLO land location and size, with location influencing its market value and uniqueness, and size benefiting women in terms of agricultural productivity and gender equality. Economic characteristics revolve around the occupation and income of JLO-holding women, influencing their decision-making authority, freedom of movement, political engagement, and entrepreneurial

opportunities. Social characteristics involve decision-making power, property control access, and cooperative membership of JLO-holding women, which enhance their economic advancement, household management, and access to financial support. The impact of JLO on rural women allows them to exercise control over resources, take on leadership roles, engage in entrepreneurship, and access financial facilities, thereby affecting land ownership, agricultural productivity, household decision-making, and food security.

3.2. Study area and population

The study area was the Sunsari district of Koshi Province of Eastern Nepal (Fig. 2). Hills surround Sunsari from the north with the neighbor boundary district of Dhankuta, Koshi-river along with Saptari and Udayapur from the west, Budhi and Kesaliya-river along with Morang district from the east and Bihar state of India from the south (Sunsari District Profile, 2017). The total area of Sunsari district is 1257 square kilometers. A natural border with rivers and hills draws the district border (Khadka and Bhattarai, 2023).

Sunsari District in 2021: Covering 16.67% forest, 71.87% agriculture, and 4.90% water, this district experiences tropical and temperate climates, with an average temperature of 27.50 °C (Sunsari District Profile, 2017). It is home to 110 castes, including 91,500 Tharus and 88,173 Muslims, with 71 languages spoken (NSO, 2023). Predominantly Hindu (63.27%), the district’s topography ranges from 75 m in the Terai to 1200 m in the hills (Gartaula et al., 2010). The census reports 162,407 households, a population of 753,244 (390,693 females and 362,551 males), a 1.99% population growth rate, and a rural-urban split of 537,780 and 225,707, respectively (NSO, 2017). Approximately 54% of the population is part of the working population, with 47% engaged in agriculture; notably, 65% of women work in this sector (CBS, 2011). However, women’s land ownership stands at 10.5%, with Joint Land

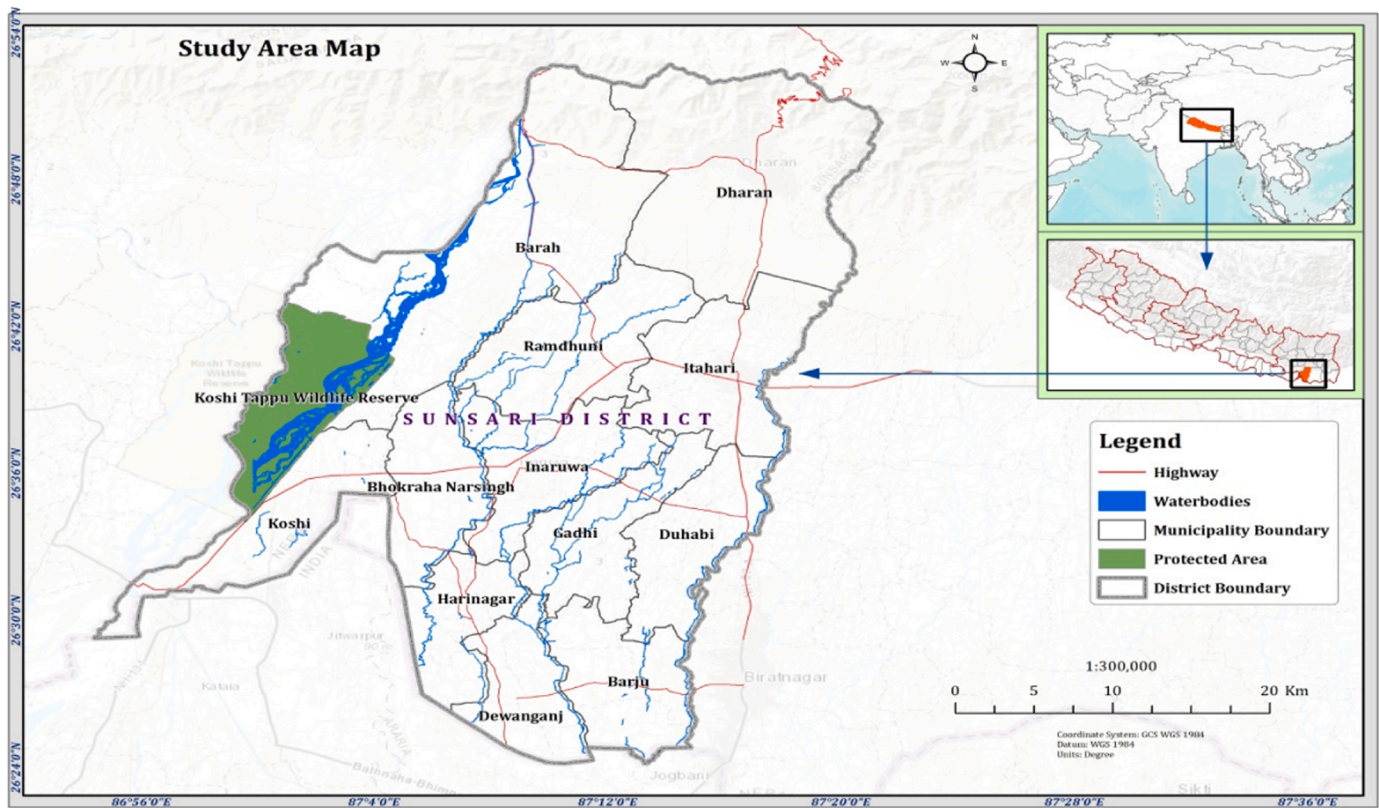


Fig. 2. Map of Study Area.

Ownership (JLO) being negligible (MOFAGA, 2017). The per capita income is 683 US dollars, and the average household size is 4.7 ha, with a human settlement area of 75,141.3 ha and a population density of 10.16 per hectare. The district boasts a literacy rate of 69%. Governance is represented by two Sub-metropolitan cities (Dharan and Itahari), four municipalities (Baraha, Ramdhuni, Inaruwa, Duhabi), and six Rural municipalities (Gadi, Bhokraha, Koshi, Harinagara, Barju, Dewanganj), encompassing 124 wards (MOFAGA, 2017).

3.3. Data sources and analysis

The study used a panel data set from 2015 to 2020. The study specifically examines the demographic status of JLO-holding women and the data is based on responses from 111 married women in SunSari district who possess JLO certificates. These women were certified by the District Land Rights Forum SunSari, representing various areas within SunSari where more than 200 spouses have participated in the JLO program. The JLO data were collected through two surveys conducted in 2015 (before JLO) and 2020 (after JLO).

Data related to JLO were collected from the District Land Revenue Office SunSari, District Land Rights Forum (DLRF) SunSari, National Land Rights Forum (NLRFF) and then verified from Abhiyan Nepal SunSari, Community Self-reliance Centre (CSRC) Kathmandu, and Central Bureau of Statistics (CBS). Additionally, socio-economic and rural women empowerment data were obtained from different Village Land Right Forums (VLRFF) in SunSari, while national JLO data came from CSRC and the Ministry of Land Management, Cooperative and Poverty Alleviation (MoLCPA).

Various other sources such as economic surveys, publications from the CBS, National Planning Commission (NPC), World Development Report (WDR 2018), as well as official and unofficial documents from international non-governmental organizations (INGOs), non-governmental organizations (NGOs), newspapers, and other published

and unpublished sources were also utilized. The collected data were compiled into a dataset that includes demographic characteristics, land ownership details, socioeconomic status, and women empowerment indicators. Microsoft Excel and Word file is used for data input and tabulation and STATA software for coding, adding and computing variables. Similarly, hypothesis testing and assessment of the empowerment of rural women through JLO was done using the binary logistic analysis in STATA.

3.3.1. Quasi-experimental approach and pre-test post-test research design

A quasi-experimental design is employed to assess the socio-economic impact of Joint Landed Ownership (JLO) on women's empowerment. The design involves comparing a group of women before they acquired JLO with the same group after they obtained JLO, allowing for cause-and-effect analysis. The study collects data at two time periods, capturing the baseline (pre-intervention) and measuring the outcomes of women's empowerment after the implementation of the JLO policy. This design is under the broader category of pre-test and post-test designs within the quasi-experimental technique. In this study, the control and experimental groups are the same, and the researcher collects data from the respondents twice, before and after the JLO intervention. The design compares and analyzes dependent and independent variables, assessing the impact of JLO on rural women's empowerment. By assigning JLO holding participants to treatment conditions, this design functions as a true experiment and offers insights into the effectiveness of JLO in promoting rural women's empowerment.

Because of the nature of the pre-test and post-test data, pooled regression statistics and logistic regression analysis are used for data inference. With probability values ranging from 0 to 1, the logistic regression analysis provides acceptable statistical features (Hu et al., 2006). In investigating the socioeconomic impact of JLO on rural women's empowerment, the binary logistic regression model is used since the nature of the data value ranges lay 0–1. Conceptual

frameworks and literature studies assess the impact of JLO. Following prior research, we selected a logit regression model to uncover the main variable that affects rural women’s empowerment. JLO substantially impacted rural women’s empowerment (Mishra and Sam, 2016).

Assume Y is the rural women empowerment (RWE) dependent variable, and X represents socioeconomic and demographic factors as independent variables while estimating the binary logit model. We use the logit model in this study as the inferential statistical analysis for such a dichotomous impact (Devkota et al., 2018). The model is as follows:

The impact of X on the response probabilities $P(y = j/x)$ may be evaluated using the binary logit model (Devkota et al., 2018).

$$P\left(\frac{y^j}{X}\right) = F(Z_i) = \frac{e^{Z_i}}{1 + e^{Z_i}} + \frac{e^{-Z_i}}{1 + e^{-Z_i}}$$

$$P(y = j | x) = F(Z_i) = \frac{e^{Z_i}}{1 + e^{Z_i}} + \frac{e^{-Z_i}}{1 + e^{-Z_i}}$$

$$Z_i = \beta_0 + \beta_1 X_{1i} + \dots + \beta_n X_{ni} + \mu_i \tag{i}$$

This research employs the Eq. (i) in the model, and then the final logistic regression Eq. i.

$$RWE = \beta_0 + \beta_1 \text{Land Size} + \beta_2 \text{Income} + \beta_3 \text{Occupation} + \beta_4 \text{Ethnicity} + \beta_5 \text{Household Size} + \beta_6 \text{Household Decision} + \beta_7 \text{Cooperative Membership} + \beta_8 \text{Property Ownership} + \epsilon \tag{ii}$$

We presented the expected signs and variables in Table 3.

4. Results and discussions

4.1. JLO land ownership status

In the context of land ownership in Sunsari district, it’s evident that JLO registrations are predominantly linked to the husband’s land ownership (94.5%), followed by the wife’s land ownership (5.5%), and newly purchased land (2%). This highlights the influence of patriarchal norms and inheritance laws in Nepal, which favor transferring land to sons. Female ownership of housing, land, and property in Nepal was reported at 19.7% in 2011. Among 111 women with JLO in Sunsari, 77% reside in rural areas, with only 23% in urban areas, reflecting the

Table 3
Expected signs and variables.

Variables	Descriptions	Data code value	Sign
Dependent Variable			
Rural Women Empowerment (RWE)	RWE is based on JLO holding women of rural and urban land location	1 = JLO holding rural women 0 = Otherwise	±
Independent Variables (IV)			
Land size	The area of JLO land	In Katha (1 Katha = 0.034 hectore)	-
Income	Monthly income of respondents before and after JLO	In United States Dollar	+
Occupation	Occupational status of respondents before and after JLO	1 = Agriculture 0 = Otherwise	+
Ethnicity	The Respondent’s Castes belong to	1 = Adibasi 0 = Otherwise	±
Household Size	Number of family members of respondents	In number	-
Household Decision	Decision-Making Power in Family before and after JLO	1 = Yes 0 = No	+
Cooperative Membership	Membership status of the cooperative organization before and after JLO	1 = Yes 0 = 0	+
Property Ownership	Access to property control in the family before and after JLO	1 = Yes 0 = No	±

historic lack of land ownership among rural women compared to their land-owning husbands. Additionally, most JLO land is small, with 58% of respondents holding less than one "Katha" (a unit of land measurement). This limitation is attributed to economic constraints and the rising cost of land. The primary use of JLO land is for housing (74%), followed by agriculture (4%), and a combination of housing and agriculture (22%). This underscores the significance of housing for shelter and identity, aligning with land reform initiatives aimed at addressing residential needs amid a growing population (Lastarria-Cornhiel, 2003; Chakrabarti, 2018; CDS, 2013).

4.2. Demographic factors

Demographic factors among Joint Land Ownership (JLO) women, such as age, ethnicity, household size, education, and housing conditions, play significant roles in rural empowerment (Khanal et al., 2020; Chayal and Dhaka, 2016; Ogbuehi, 2020). In Sunsari, a survey of 111 JLO-holding women revealed that those aged 36–45 years were more active in land utilization. Ethnic distribution aligned with census data, and household sizes varied, with a preference for traditional and nuclear family structures.

The study shows that there are different casts belonging to ethnic groups of respondents. Out of 111 respondents, ethnic belongs to Bramin are 10% (i.e., 11), Chhetri are 8% (i.e., 9), Janajati are 13% (i.e., 14), Adibashi are 65% (i.e., 72) and Dalit are 4% (i.e., 5) respectively. The study finds that 78% of respondents belong to the ethnic group.

Education, an essential empowerment tool, showed disparities between rural and urban women, with urban women generally better educated. Housing conditions improved after becoming JLO holders, with a shift toward more secure housing options, notably rod, concrete, and cement (RCC) buildings. Resourceful women demonstrated a strong commitment to household management post-JLO, particularly in rural areas (Chayal and Dhaka, 2016; Ogbuehi, 2020). The study investigating JLO holding women and their demographic factors provides valuable insights. Age emerges as a key determinant of women’s land ownership, with younger rural women displaying higher engagement in agricultural activities. The respondents represent diverse ethnic groups, with indigenous populations concentrated in remote Terai regions. Traditional household structures, primarily nuclear families, prevail among the respondents. Education plays a vital role in empowering women and facilitating their participation in socio-economic endeavors and decision-making processes. However, there has been limited progress in education levels over five years. Following JLO holding, housing conditions have improved, particularly with a notable increase in secure RCC buildings. Overall, these findings underscore the significance of addressing demographic factors to promote the empowerment and well-being of rural women.

4.2.1. Social factors of JLO women

Before JLO, most women had limited household decision-making power and property control access, with low involvement in cooperatives. After JLO, a significant shift occurred, empowering women to take on prominent roles in decision-making, property control, and cooperative membership, thus enhancing their social and economic well-being. The JLO has become a pivotal tool for measuring women’s status in their families, fostering empowerment (Table 4).

JLO empowers women to access credit facilities, resulting in a substantial increase in their average credit access, positively impacting their economic well-being. The survey of 111 respondents revealed a shift in their main occupations, with a decline in agriculture and an increase in business and foreign employment, reflecting the improved economic prospects enabled by JLO. JLO has not only become a fundamental resource for accessing credit but has also elevated women’s occupational status, motivating them to pursue more lucrative opportunities (Table 2).

Table 4
Social Status of Women Before (2015) and After JLO (i.e., 2020).

Variables	Before JLO	After JLO
Housing Conditions for Respondents	8	5
• Rental	87	71
• Tin-roofed house	10	4
• Thatched roof house	6	31
• RCC house		
HH Decision Making Power of Women	2	65
• High HH decision making power	109	46
• Low HH decision making power		
Property Control Access	107	49
• Husband access on property	1	18
• Wife access on property	3	44
• Both access on property		
Credit Access Status (in USD)	73	24
• No any Credit	18	3
• 1 – 50	12	8
• 51 – 100	2	10
• 100 – 150	6	66
• 150 Above		
Occupation of Respondents	104	92
• Agriculture	1	8
• Business	2	2
• Government	2	2
• Teaching	2	6
• Agriculture labor	0	1
• Foreign employment		

4.2.2. Economic characteristics of JLO women

JLO significantly impacts women’s economic well-being by boosting their monthly income levels, with JLO land serving as a pivotal resource for income generation and entrepreneurship. The study, based on Fig. 3, demonstrates a substantial shift in women’s monthly income before and after JLO, showcasing a marked increase in the number of women earning above USD 100 per month post-JLO. This highlights the instrumental role of JLO in enabling women to access loans for entrepreneurship and engage in economic activities that promote income generation and empowerment (Fig. 3).

JLO empowers women economically, reflected in a significant increase in their monthly savings. The study of 111 respondents, depicted in Fig. 4, illustrates this growth, with the majority saving between USD 6 and 55.03 per month post-JLO. JLO not only facilitates credit access for entrepreneurship but also underscores the importance of savings for future economic security, emphasizing women’s economic empowerment (Fig. 4).

4.3. Summary statistics

JLO has a profound positive impact on various aspects of women’s lives including income, occupation, housing conditions, decision-making power, credit access, entrepreneurship involvement, cooperative membership, and monthly savings as shown by the result of paired-sample t-test (Table 5). The result of the group means the comparison of variables undertaken for this study indicates a significant positive change in JLO women’s status from 2015 to 2020. These changes are statistically significant, demonstrating the positive impact of JLO on the empowerment of the women residing in rural areas. The study findings underscore the pivotal role of JLO in enhancing the socio-economic performance of women and fostering their empowerment (Chayal and Dhaka, 2016; Ogbuehi, 2020).

4.4. Inferential analysis

4.4.1. Pre-estimation tests

To confirm the suitability of data used for the analysis pre-estimation test were performed. In this test, it performed a link test to find specification error, goodness of fit and other diagnostic tests as fit-stat (Table 6). The idea behind the link test is that if the model is properly specified, one should not be able to find any additional predictors that are statistically significant except by chance (Heckman, 2013). After the regression command (in our case, logit or logistic), the link test uses the linear predicted value (\hat{y}) and linear predicted value squared (\hat{y}^2) as the predictors to rebuild the model. The variable \hat{y} should be a statistically significant predictor since it is the predicted value from the model. In this study, it has come to know that \hat{y} value is statistically significant ($p > 0.0000$) and \hat{y}^2 value is statistically insignificant at ($P > 0.181$). That concludes the data set has no specification error and the predictors are meaningful as they match the necessary conditions.

Another commonly used test of model fit is Hosmer and Lemeshow’s goodness-of-fit test. The idea behind Hosmer and Lemeshow’s goodness-of-fit test is that the predicted frequency and observed frequency should match closely and that the more closely they match, the better the fit (Lemeshow et al., 2013). The Hosmer-Lemeshow goodness-of-fit statistic is computed as the Pearson chi-square from the contingency table of observed frequencies and expected frequencies. Like a test of association of a two-way table, a good fit as measured by Hosmer and Lemeshow’s test will yield a large p-value. When there are continuous predictors in the model, there will be many cells defined by the predictor variables, making a very large contingency table, which would yield significant

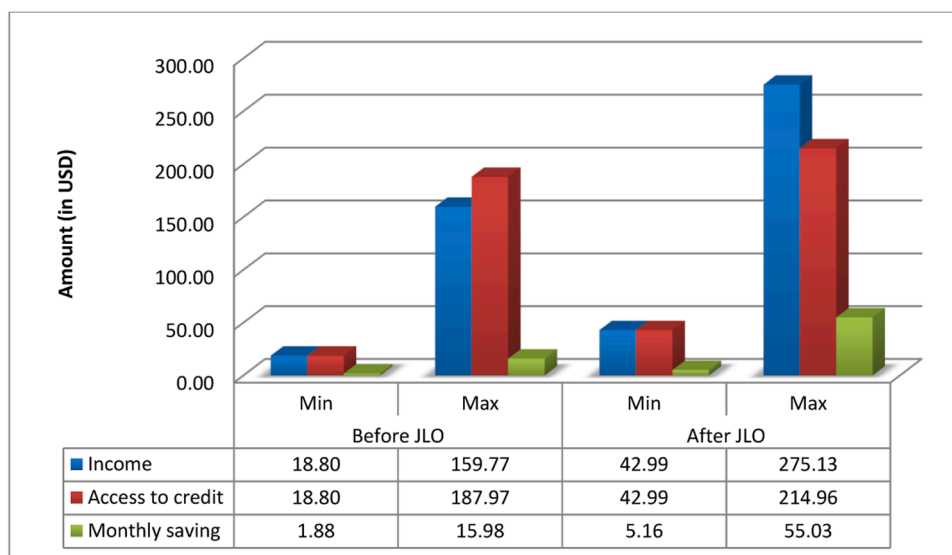


Fig. 3. Income, saving and access to credit before and after JLO.

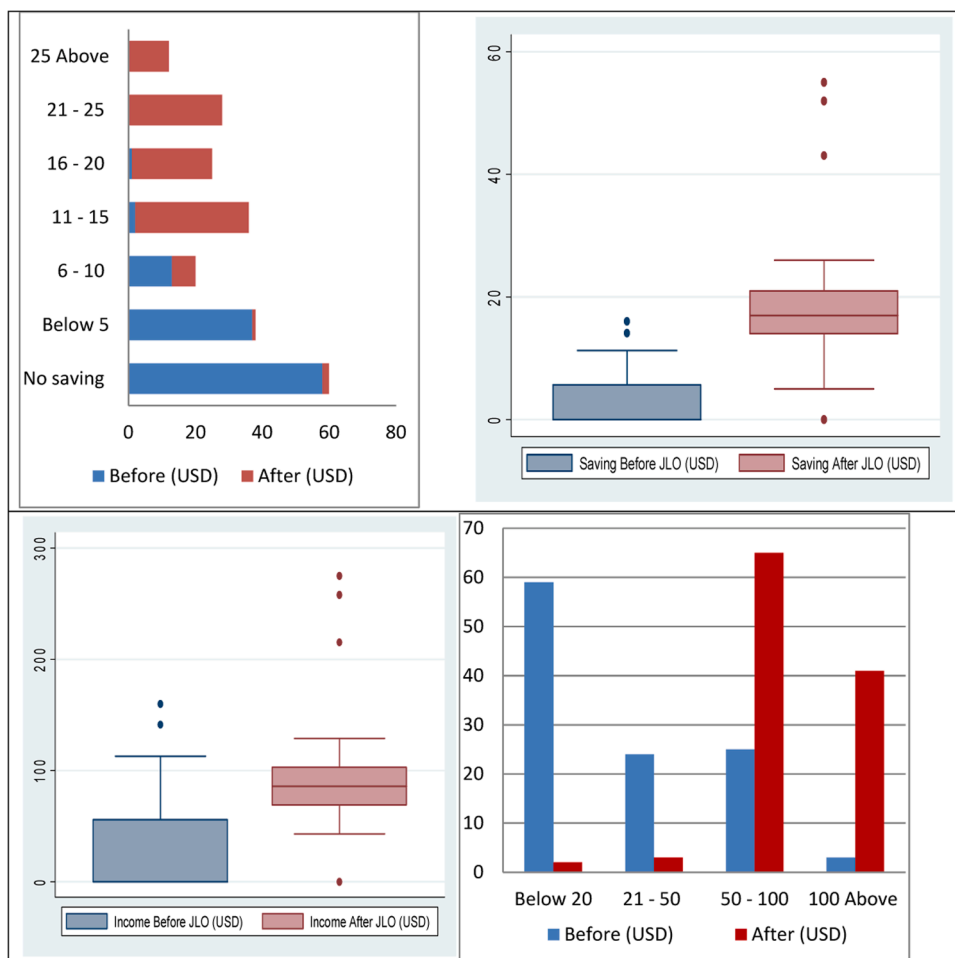


Fig. 4. Monthly Income and Saving of Respondents Before/After JLO.

Table 5
t test for the comparison of variables.

Variable name	Group	Mean	Std Dev	S.E. Mean	Mean Difference	t-test statistics	Sig (two-tailed)	Confidence interval in 95%	
								Lower Bound	Upper Bound
Income (In NRs.)	After	10483.78	4277.755	406.026	7663.944	18.940	0.0000	9679.13	11288.43
	Before	2819.82	3542.465	336.235				2153.47	3486.16
Women Occupation Status	After	1.387	1.001	0.095	0.216	3.014	0.0032	1.19	1.57
	Before	1.171	0.711	0.067				1.03	1.30
Monthly Saving (in NRs)	After	2074.77	873.703	82.928	1792.73	23.692	0.0000	1910.43	2239.11
	Before	281.98	354.246	33.623				215.34	348.61
Household Condition	After	1.30	0.614	0.058	0.162	2.125	0.0358	1.19	1.42
	Before	1.14	0.630	0.059				1.02	1.26
HH Decision Power	After	0.57	0.496	0.047	0.558	11.797	0.0000	0.48	0.66
	Before	0.01	0.133	0.012				-0.00	0.04
Access to Credit	After	31549.55	38579.02	3661.758	28432.43	7.905	0.0000	24292.8	38806.3
	Before	3117.11	5421.739	514.608				2097.28	4136.95
Entrepreneurship status	After	2.72	2.15	0.20	1.513	7.120	0.0000	2.31	3.12
	Before	1.20	1.81	0.17				0.86	1.54
Membership of Cooperatives	After	0.81	0.39	0.03	0.69	15.783	0.0000	0.73	0.88
	Before	0.11	0.32	0.03				0.05	0.17

results more than often. When the goodness of fit test is run, the model's outcome is Prob > chi2 = 0.9927. The p-value needs to be more than 5% for the goodness of fit to be present in models.

There are many other measures of model fit, such as AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion). Thus, the Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC) models of the Other Diagnostics (Fitstat) model assist in determining the quality of fit (Akaike, 1974). In this diagnostic, we focus

on counting R2; the higher it is, the better. The model's count R2 is greater than 0.7 at 0.833, making it excellent. The pre-test result analyzed by the pre-estimation tool clearly shows that the data used in the survey and the tool used for the estimation result were detected successfully for further analysis. The link test was used to detect specification errors, and it revealed that the data set had no specification error, and the predictors were meaningful. The goodness of fit test indicated a good fit of the model, as the p-value was greater than 5%.

Table 6
Pre-estimation tests of the JLO related variables.

Test	Before JLO	After JLO	Combined
Specification Error test			
Number of obs	109	109	222
_hat	0.95***	0.94***	0.88***
_hatsq	0.27	0.39	0.96
_cons	-0.23	0.04	-1.32
LR chi2(2)	35.69	45.46	82.65
Prob > chi2	0.00	0.00	0.00
Pseudo R2	0.31	0.38	.34
Log likelihood	-39.61	-37.15	-79.51
goodness-of-fit test			
number of covariate patterns	96	106	206
Pearson chi2(88)	79.21	78.97	144.99
Prob > chi2	0.7374	0.91	0.99
Other Diagnostics			
Log-Lik Intercept Only	-57.458	-59.883	-120.844
Log-Lik Full Model	-39.636	-37.229	-80.385
Prob > LR	0.00	0.00	0.00
McFadden's R2	0.310	0.378	0.335
Maximum Likelihood R2	0.279	0.340	0.305
McKelvey and Zavoina's R2	0.578	0.594	0.511
Cragg & Uhler's R2	0.428	0.510	0.460
Efron's R2	0.318	0.388	0.331
Variance of y*	7.804	8.111	6.726
Variance of error	3.290	3.290	3.290
Count R2	0.826	0.835	0.820
AIC	0.892	0.848	0.805
BIC	-389.862	-394.678	-990.000

Other diagnostics, such as the Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC), confirmed the quality of fit, with a high R2 value of 0.833. These results demonstrate that the data and estimation tool used in the study were suitable for further analysis.

4.4.2. Post-estimation tests

Green (2003) asserted that cross-sectional data analysis has two issues: multi-collinearity among explanatory factors and the Heteroscedasticity test in the error term. As per Alin (2010), multicollinearity is a condition in which two or more variables exhibit linear relationships. It arises when the independent variables in a regression model are correlated. Choumert and Phélinas (2015) said that if the Variance Inflating Factor (VIF) value does not exceed 10, the study is free of multicollinearity in the regression model. As per the results (Shown in Table 5), all independent variables have tolerances greater than 0.01, and the variance inflating factor (VIF) is less than 10. The average VIF is also 1.97. There is multicollinearity if VIF is bigger than 10. As a result, the data set has no multicollinearity (Klein et al., 2016).

Heteroscedasticity is the variability of one variable that is not equal to the projected range of another variable. It arises when the variance of the error term for the range of observations differs. It's critical to recognize heteroscedasticity as the problem with regression analysis findings. Regarding the hot test on our data set, the result that was observed for the model is ($P > \chi^2 = 0.0000$). If the value is less than 0.05, the assumption implies that there is heteroscedasticity. Heteroscedasticity is, therefore, present in the model's instance. Hence, a robust standard error test is required to correct the problem. The post-test confirmed that the dataset is free from multicollinearity, ensuring the validity of further analysis. However, heteroscedasticity was identified as an issue during the analysis. To address this problem, the final regression was conducted using robust standard errors.

4.5. Regression results

The binary logistic results estimating the probability of women empowerment conditional on various independent characteristics such as independent variables, i.e., land size, income, occupation, ethnicity, household size, household decision, cooperative membership, and

property ownership are presented in Table 8.

The value of Wald χ^2 (8) for the three models is 30.84, 35.34 and 82.25 respectively. Similarly, the value of Pseudo R² is 0.3102, 0.3783 and 0.3348 respectively. The log-likelihood value is - 39.63, - 37.22 and - 80.38 respectively. All these criteria state that the model is fit and applicable for further analysis. So, all three models have been further analyzed by three processes, i.e., logit coefficient, odds ratio and marginal effect. The first model including 111 respondents before JLO indicates that only household size is positively associated with rural women empowerment. On the other hand, occupation and ethnicity are negatively associated with rural women's empowerment. Model 2 considers other 111 respondents after the JLO intervention. Here too, occupation, ethnicity and household decision are statistically significant with negative signs, indicating after JLO rural women empowerment by these variables has declined. Each model has less ground to believe that the data we use is only based on 111 respondents.

Hence, we combine the dataset, now it is 222 respondents, to see the effect of JLO on rural women's empowerment. Thus, model 3 shows rural women empowerment through JLO, and indicates that rural women empowerment is associated with land size, occupation, ethnicity, household size, household decision, and cooperative membership. Occupation, ethnicity and household decision are found to be negatively associated with rural women empowerment after JLO, however, it is positively associated with land size, household size and cooperative membership. In summary, Model 3 shows that an increase in the availability of land size and cooperative membership facilities plays a statistically significant role in enhancing rural women's empowerment regardless of other conditions available to them. In addition, JLO helps to promote diverse occupations and promote cooperative membership.

In Nepal, land carries great significance, symbolizing economic well-being, social prestige, and political influence (Rai et al., 2020). While female land ownership in Nepal was historically limited, the implementation of the Joint Landed Ownership (JLO) policy in 2011 has brought about substantial positive changes in women's lives, particularly in rural areas. JLO has led to significant increases in income (87.21%), occupation (22%), housing conditions (16%), decision-making power (56%), credit access (241%), entrepreneurship involvement (56%), cooperative membership (69%), and monthly savings (270%) for women. This underscores the pivotal role of JLO in empowering rural women economically and socially, aligning with earlier research findings (Cai et al., 2020; Anderson and Eswaran, 2009; Mishra and Sam, 2016). This study also found that there is an odd of progress on RWE due to a significant effect of land size, occupation, ethnicity, household size, household decision, cooperative membership and property ownership control then the RWE increases by 1.124, 0.351, 0.427, 2.693, 0.129, 3.036, 0.942 times respectively. It means higher performance on socio-economic factors due to JLO and higher performance of rural women empowerment in Nepal, the findings inclined with the observation made by Chigbu (2019) in Nigeria. The positive marginal coefficient of land size, household size, and cooperative membership positively affect the performance of RWE by 0.0118, 0.0997 and 0.112 times and the negative marginal coefficient of occupation ethnicity negatively affects the performance of RWE by 0.105 and 0.0855 times, respectively. This result indicating there is positive causation among the JLO empowered rural women and the cause-and-effect relationship can go hand-on-hand for the betterment of ethnic group, land holders and household size prevailed at the region. Their successful story may lead further development in the concept and ultimately provides benefits to the national and other developing countries where JLO is taken as tools to improve women empowerment, that ultimately enhance more and better jobs for women as mentioned by Lim (1996) and ultimate success of the women empowerment (Eisenstein, 2015).

Gender equality, women's rights, and empowerment is the top priorities issues of Nepal government in the last two decades (Joshi et al.,

Table 7
Posttest estimations.

Variables	Before JLO				After JLO				Combined			
	VIF	SQRT VIF	Tolerance	R ²	VIF	SQRT VIF	Tolerance	R ²	VIF	SQRT VIF	Tolerance	R ²
Multicollinearity Test												
Land Location	1.52	1.23	0.65	0.34	1.56	1.25	0.64	0.35	1.50	1.23	0.66	0.33
Land Size	1.23	1.11	0.81	0.18	1.23	1.11	0.81	0.18	1.17	1.08	0.85	0.14
Income	1.49	1.22	0.66	0.33	1.87	1.37	0.53	0.46	2.47	1.57	0.40	0.59
Occupation	1.22	1.11	0.81	0.18	1.58	1.26	0.63	0.36	1.40	1.18	0.71	0.28
Ethnicity	1.41	1.19	0.70	0.29	1.48	1.22	0.67	0.32	1.39	1.18	0.71	0.28
Household Size	1.17	1.08	0.85	0.14	1.45	1.21	0.68	0.31	1.21	1.10	0.82	0.17
Household Decision	1.23	1.11	0.81	0.18	2.76	1.66	0.36	0.63	3.23	1.80	0.31	0.68
Cooperative Membership	1.15	1.07	0.86	0.13	1.14	1.07	0.87	0.12	1.68	1.30	0.59	0.40
Property Ownership	1.25	1.12	0.79	0.20	2.51	1.58	0.39	0.60	2.86	1.69	0.34	0.65
Mean VIF	1.30				1.73				1.88			
Heteroscedasticity Test												
chi2(1)	18.48				24.58				50.14			
Prob > chi2	0.00				0.00				0.00			

Table 8
Logistic Regression: Rural Women Empowerment (RWE) through JLO.

VARIABLES	RWE Before JLO			RWE After JLO			Combined RWE from JLO		
	Logit Model	Odds ratio	Marginal effects	Logit Model	Odds ratio	Marginal effects	Logit Model	Odds ratio	Marginal effects
Land Size	0.272 (0.270)	1.313 (0.355)	0.0312 (0.0295)	0.111 (0.0698)	1.117 (0.0780)	0.0120 (0.00748)	0.117 ** (0.0460)	1.124 ** (0.0517)	0.0132 ** (0.00519)
Income	9.20e-05 (8.13e-05)	1.000 (8.13e-05)	1.05e-05 (9.55e-06)	8.52e-05 (0.000101)	1.000 (0.000101)	9.20e-06 (1.06e-05)	8.14e-05 (5.15e-05)	1.000 (5.15e-05)	9.22e-06 (5.92e-06)
Occupation	-1.100 ** (0.446)	0.333 ** (0.148)	-0.126 *** (0.0456)	-0.962 *** (0.338)	0.382 *** (0.129)	-0.104 *** (0.0321)	-0.868 *** (0.177)	0.420 *** (0.0743)	-0.0984 *** (0.0189)
Ethnicity	-0.677 ** (0.207)	0.508 *** (0.105)	-0.0775 *** (0.0221)	-0.646 *** (0.224)	0.524 *** (0.117)	-0.0697 ** (0.0225)	-0.724 ** (0.151)	0.485 *** (0.0732)	-0.0820 ** (0.0150)
Household Size	0.641 * (0.368)	1.898 * (0.699)	0.0734 * (0.0433)	0.920 (0.581)	2.509 (1.458)	0.0993 * (0.0594)	0.886 ** (0.303)	2.424 *** (0.734)	0.100 ** (0.0337)
Household Decision	-	-	-	-2.144 * (1.188)	0.117 * (0.139)	-0.231 * (0.123)	-1.814 ** (0.757)	0.163 ** (0.123)	-0.206 ** (0.0856)
Cooperative Membership	-0.172 (0.840)	0.842 (0.707)	-0.0197 (0.0961)	0.943 (0.690)	2.567 (1.771)	0.102 (0.0701)	0.915 * (0.524)	2.497 * (1.308)	0.104 * (0.0572)
Property Ownership	-1.147 (1.438)	0.318 (0.457)	-0.131 (0.160)	-0.268 (0.427)	0.765 (0.326)	-0.0289 (0.0450)	-0.113 (0.442)	0.893 (0.394)	-0.0128 (0.0498)
Constant	0.439 (1.718)	1.551 (2.665)	-0.331 (3.009)	0.718 (2.160)			-0.621 (1.405)	0.537 (0.755)	
Observations	109	109	109	109	109	109	222	222	222
LR χ^2 (2)	30.84			35.34			82.25		
Prob > chi2	0.0001			0.0000			0.0000		
Pseudo R2	0.3102			0.3783			0.3348		
Log likelihood	-39.6362			-37.2285			-80.3849		

Robust standard errors in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1

2022). The current legislative regulations, such as Article 38(6) of Nepal’s 2015 Constitution, grant women access to property ownership rights (Pandey, 2010). However, limitations persist, such as married daughters not being considered coparceners for parental property and women having limited influence in household decision-making. Further, the implementation of this policy has been limited in many parts of the country. Asian countries show 8 to 13% JLO, promoting gender equality through awareness, policy, and development (Mahmud et al., 2012). Studies confirm that land rights play a crucial role in enhancing women’s empowerment and economic well-being in developing nations (Agarwal, 2003; Allendorf, 2007; Daley et al., 2013; Meinzen-Dick et al., 2019). Hence, the gap between land laws and effective JLO implementation needs to be addressed for greater gender equality in land ownership.

Observing our results and comparing other studies, it is clear that JLO helps promote rural and urban women’s empowerment and harmony in their families (Allendorf, 2007). It is therefore urging us to implement the JLO policy in Nepal with greater enthusiasm (Koirala, 2022). As it is observed, low numbers of JLO-holding women have still recorded since it came into existence in 2011, so greater participation is required. More campaigns, promotion awareness programs, women’s

rights advocacy, training and education could enhance JLO participation and rural women empowerment in Nepal. JLO, thus, may be a useful strategy to increase women’s negotiating power within the family without resulting in efficiency losses (Newman et al., 2015). The empowerment of women is positively and significantly impacted by land ownership. Land ownership’s influence on empowerment is increased by endogeneity when combined with inverse probability weighting, coarsened exact matching, and instrumental variable approaches (Misra and Sam, 2016). As a result, the findings show how well the women’s socioeconomic performance supports rural women’s empowerment because of shared land ownership. Hence, the issuance of joint land certificates has proven to be an effective policy tool in empowering women in their socio-economic lives.

5. Conclusions and implications

This study investigates the positive impact of the Joint Landed Ownership (JLO) intervention in Nepal on women’s attitudes towards land rights and their involvement in land-related decision-making. Focusing on the Sunsari district, pre-test and post-test data from 2015 and 2020 provide a comprehensive understanding of women’s socio-

economic status and a precise assessment of rural women's empowerment. The findings indicate that JLO significantly contributes to women's empowerment, with variables such as land size, occupation, ethnicity, household decision-making power, cooperative membership, and household size showing statistical significance. Women's land ownership positively influences occupational activities and household decision-making, particularly among culturally aware ethnic groups. However, JLO does not exhibit statistical significance about property ownership, household size, and income level, likely influenced by cultural norms and economic factors. Importantly, the study highlights that women's land ownership in Nepal significantly enhances their empowerment, as reflected in increased participation in household decision-making regarding healthcare, major purchases, and family matters. These findings underscore the importance of equitable land distribution and demonstrate that the positive effects of JLO continue to grow over time, as evidenced by various socio-economic indicators.

The study's findings yield several implications:

- Enhancing JLO registration and awareness programs for rural women,
- Fostering collaboration among spouses, communities, community organizations, and the government for effective JLO policy implementation,
- Mandating joint land registration for inherited and newly acquired property to challenge patriarchal norms and inheritance laws,
- Facilitating JLO-holding women's access to low-interest home loans through financial institutions,
- Reviewing land policies pertaining to JLO schemes to promote women's participation,
- Promoting cooperation between JLO-holding women and their husbands to prevent land resource misuse.

This study however has limitations, and further research covering broader geographical area is needed to provide a comprehensive understanding on causal relations clarifying sources of variation of the socio-economic impact of JLO on women and generalization of our research findings.

CRediT authorship contribution statement

Khadka Umesh: Software, Methodology, Formal analysis, Data curation, Conceptualization. **Khanal Ghanashyam:** Writing – review & editing, Validation, Supervision, Methodology, Formal analysis. **Deuja Jagat:** Writing – review & editing, Validation, Resources, Methodology, Data curation. **Marasini Tek:** Writing – review & editing, Validation, Supervision, Methodology, Formal analysis. **Ghimire Puspa Raj:** Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Devkota Niranjana:** Writing – review & editing, Visualization, Supervision, Software, Methodology, Data curation, Conceptualization.

Declaration of Competing Interest

We declare that we have no conflict of interest in publishing this manuscript.

Data Availability

Data will be made available on request.

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