International Journal of Research and Review
[Indexed, Peer-Reviewed Journal]
Volume 12; Issue: 6; June 2025
Website: www.ijrrjournal.com
Research Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Contribution of Tribal Women Farmers to the Agricultural Sector: A Study of Kandhamal District

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DOI: https://doi.org/10.52403/ijrr.20250679

ABSTRACT

This research offers a comprehensive socio-economic assessment of tribal women's participation in agriculture across the Kandhamal District of Odisha. Employing a mixed-methods approach, it combines structured surveys (n=472), interviews, and focus group discussions to investigate how demographic characteristics, spatial dynamics, and institutional access influence women's income, labor contributions, and livelihood resilience. Initial data analysis uses descriptive statistics and cross-tabulations to evaluate income patterns based on marital status, age, family size, education level, landholding type, and distance to market. Women residing within 2-3 km of markets report significantly higher incomes, underscoring the importance of geographic accessibility in rural livelihoods. Income disparities are further examined across blocks and farming types. Further, the study analyzes labor input (man-days), income per acre, and income per man-hour across crop types. Pulses and oil-seeds yield the highest returns, while paddy and turmeric are labor-intensive with lower productivity, indicating the need for crop diversification and labor-saving innovations.

Keywords: Tribal Women, Farmers, Agricultural Participation, SDG

INTRODUCTION

Agriculture serves as the foundational pillar of India's economy, providing livelihoods for a large portion of the population. With a history spanning around 10,000 years, India today ranks second globally in agricultural production. The sector includes field crops, fruits, plantation crops, livestock, forestry, and fishery forming a massive industry that engages approximately 52 % of the nation's workforce. Show a marked rise in women's participation in India's agricultural workforce. Agriculture ranks among humanity's oldest professions, existing since the dawn of civilization. Rural women often balance farm work, animal care, and household chores tasks that are frequently grueling and physically demanding. Deep-rooted social and religious norms label women as secondary and subordinate, leaving them vulnerable, dependent, and subject to exploitation in both farming and labor roles. In India, of the 30 million women in the workforce, 20 million are

rural. Their daily routines are tiring: during peak agricultural seasons, they typically spend 8-9 hours a day working in the fields plus around 4 hours on household duties. Some farming activities even rely more on women than men (Singotiya et al., 2014). Yet, persistent wage disparities between male and female cultivators remain unresolved. This study examines the underlying causes of increased female agricultural employment and the barriers especially pay inequality that hinder genuine empowerment. While government initiatives have begun to support women in farming, empowering change also hinges on shifting societal attitudes, securing men's support, and enabling more flexible working arrangements. (Periodic Labour Force Survey data (2017–2024). Agriculture sectors are the backbone of both the Indian economy and the state of Odisha, with around 60% of the state's population relying on these activities for their livelihood. (Agriculture Statistics 2018-19). In Odisha, about 85% of rural women work in agriculture (Economic Survey, Odisha 2020-21). Despite their vital role, they often lack equal access to land, irrigation, and technology. Nationwide data from the National Sample Survey (2018-19) shows women hold just 13.5% of rural land ownership-a pattern mirrored in Odisha. Many women without land serve as laborers or assist informally on family farms, typically receiving no formal recognition or pay.

This study aims to examine the socio-economic factors influencing tribal women's attitudes toward agricultural work, particularly in light of increasing female participation and persistent barriers such as wage inequality, limited access to land and technology, and entrenched gender norms. While government programs have begun to support women farmers, genuine empowerment requires deeper societal transformation—supported by policy reforms, male engagement, and flexible labor conditions.

LITERATURE REVIEW

The reviewed studies collectively emphasize the critical yet often underrepresented role of women in agriculture across various global contexts, highlighting both progress and persistent gaps. Ball (2020) provides an interdisciplinary review that exposes the lack of economic research on women farmers in developed countries, especially in terms of productivity and resource access—issues well studied in developing nations. This complements findings by the SOFA Team and Doss (2011), who, using empirical data and time-use surveys, reveal that women comprise about 43% of the agricultural labor force in developing countries but remain largely confined to unpaid and low-wage roles, with limited access to resources and decision-making power. Dimon et al. (2025) build on this by showcasing women's active engagement in livestock, particularly sheep and goat rearing in sub-Saharan Africa, where their involvement significantly contributes to household income and food security, reinforcing the importance of gender-sensitive livestock development policies. Further extending the discussion, Vidyawati and Jadoun (2025) highlight how India's decentralized agricultural training programs like NMAET and ATMA have supported smallholders and empowered women through capacity-building and modern farming practices. Together, these studies underscore a global need for more inclusive agricultural policies and comparative gender-focused research that integrates women's contributions across crops, livestock, and training systems to strengthen sustainable development outcomes.

MATERIALS & METHODS

Statistical techniques including descriptive statistics, correlation analysis, and regression models were utilized to interpret the relationship between variables such as landholding size, labor input, and income generation. The combination of empirical data collection and robust analytical models ensures the reliability and validity of

findings, offering both depth and breadth in understanding the socio-economic dynamics of tribal women in agriculture. This methodological approach supports informed policy recommendations aimed at enhancing the recognition and support of women's roles in rural economies.

RESULTS

1. Income Distribution by Marital Status and Market Distance

Table 1 highlights distinct income patterns among tribal women based on marital status and their proximity to markets. Married individuals exhibit relatively stable income levels across distances, peaking at Rs. 44,548 in the 8–9 km range. This consistency may reflect the advantage of dual incomes in married households. Unmarried individuals earn the highest near markets, with a peak of Rs. 50,500 at 2–4 km, but experience a sharp decline in income as distance increases. Widows attain their highest income at 2–3 km (Rs. 47,083), but face steeper declines than other groups at greater distances, indicating greater economic vulnerability. These patterns emphasize the critical role of market proximity in income stability. They also suggest a need for targeted interventions to support widowed and unmarried women, especially those in remote areas, to address disparities and improve economic resilience. Figure 4.1 visualizes income trends by marital status across different distances to market. Across all distance categories, married tribal women consistently represent the largest group, suggesting their dominant role in income-generating activities. The highest counts are observed in the 2–3 km and 6–7 km ranges, potentially indicating clusters of settlements or greater population densities of economically active married women in these zones.

Table 1: Mean Income by Distance and Marital Status

Distance	Unmarried	Married	Widow
1–2 km	-	36,362	30,000
2–3 km	50,500	43,020	47,083
3–4 km	50,500	43,667	-
4–5 km	40,250	41,868	43,667
5–6 km	30,000	44,277	38,200
6–7 km	41,714	42,528	40,250
7–8 km	-	37,885	30,000
8–9 km	-	44,548	30,000

Married women's presence across all distance brackets underscores their widespread engagement with market-linked livelihoods. This pattern could also be shaped by settlement structures, where tribal villages are located a few kilometers from market centers, requiring regular travel for economic participation. Their broad distribution suggests resilience and adaptability, even in the face of limited transportation or infrastructure. The low participation of unmarried and widowed women may highlight socio-cultural and logistical barriers to economic inclusion. These trends merit deeper exploration to better understand the underlying dynamics and inform inclusive livelihood strategies.

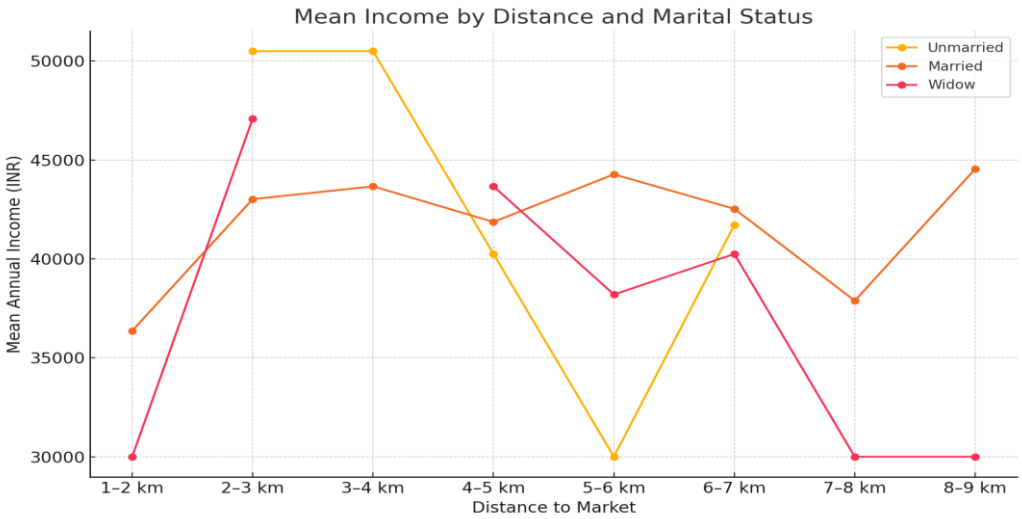

Figure 1: Annual income distribution by distance and marital status

2. Income Distribution by Market Distance and Age Group

Table 2 and the corresponding Figure 4.2 combined analysis of the mean annual income by distance from home to market and age group among tribal women engaged in agriculture. The 26–30 and 41–45 age groups consistently earn higher incomes, especially at closer distances (Rs. 47,938 at 2–3 km). The 36–40 and 51 and above age groups have more modest income values, with limited variation across distances. All age groups see a slight dip in income at 4–5 km, followed by a mild recovery at 6–7 km. The 46–50 age group peaks at 4–5 km with Rs. 45,676, suggesting earning potential may not always decline with distance. Age plays a role in income variation by distance. Younger adults (26–30) and mid-career individuals (41–45) seem to earn the most consistently. This suggests a need for age-specific policy planning, especially for older adults whose income may stagnate regardless of market proximity.

Table 2: Mean Income by Distance and Age Group

Distance	Age Group					
	26–30	31–35	36–40	41–45	46–50	51+
2–3 km	47,938	44,094	38,200	47,938	46,882	40,933
4–5 km	40,250	39,111	43,667	39,111	45,676	40,250
6–7 km	42,813	44,806	40,250	43,667	38,969	42,300

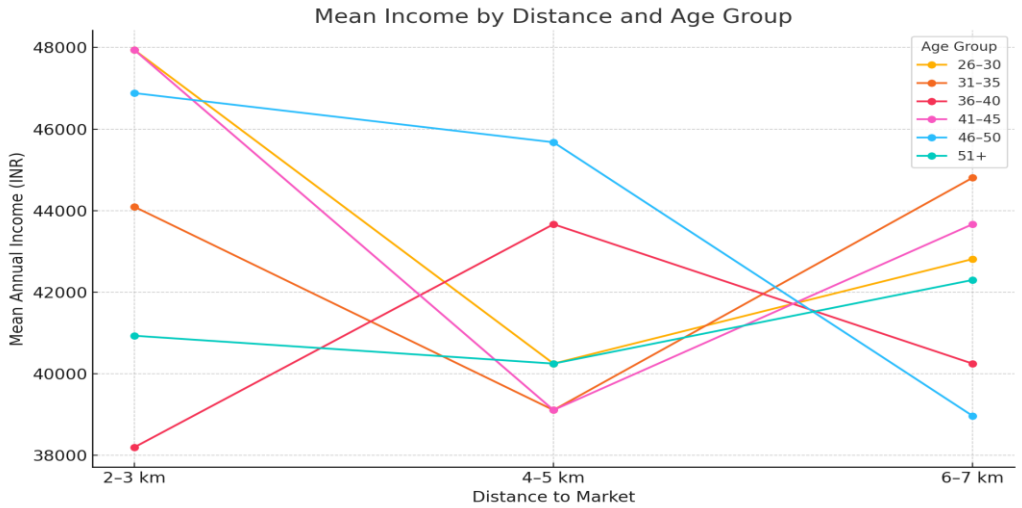

Figure 2: Mean Income by Distance and age Group

3. Income Distribution by Distance and Family Size

Table 3 represents Mean Income by Distance & Family Size. Distance from 2–3 km income tends to be relatively high across all family sizes, especially for sizes 3, 4, and 7. Mixed values with the highest average income (Rs. 47,083) seen for family size 6, but lower income for family size 4 with 4–5 km. Distance from home to market with 6–7 km consistent mid-range incomes, but generally lower than 2–3 km for most family sizes. Shorter distance (2–3 km) is generally associated with higher average income, possibly due to better access to markets or economic centers. Larger families (6–7 members) tend to have less consistent income levels, possibly due to more dependents or varying work participation. The highest income overall (Rs. 47,083) is for family size 6 members at 4–5 km. This suggests that some mid-distance families are well-positioned economically. Improve market access for families living farther away (6–7 km), especially for larger households. Target support for family sizes 4 and 7 members at 4–5 km and 6–7 km, where income dips are observed. Figure 4.3 shows the graphical representation of women residing 2–3 km zone from market consistently higher incomes across all family sizes except 5-member families. 4–5 km yields peak income for 6-member families, suggesting a potential balance of labor and market access. 7-member families show the steepest income decline with increasing distance. Family size interacts with distance, affecting labor input, consumption needs, and income generation differently.

Table 3: Mean Income by Distance and Family Size

Distance	Family Size				
	3 Members Family	4 Members Family	5 Members Family	6 Members Family	7 Members Family
2–3 km	45,185	45,676	38,200	41,714	45,375
4–5 km	44,026	37,885	44,909	47,083	40,250
6–7 km	42,615	44,350	40,250	44,643	38,200

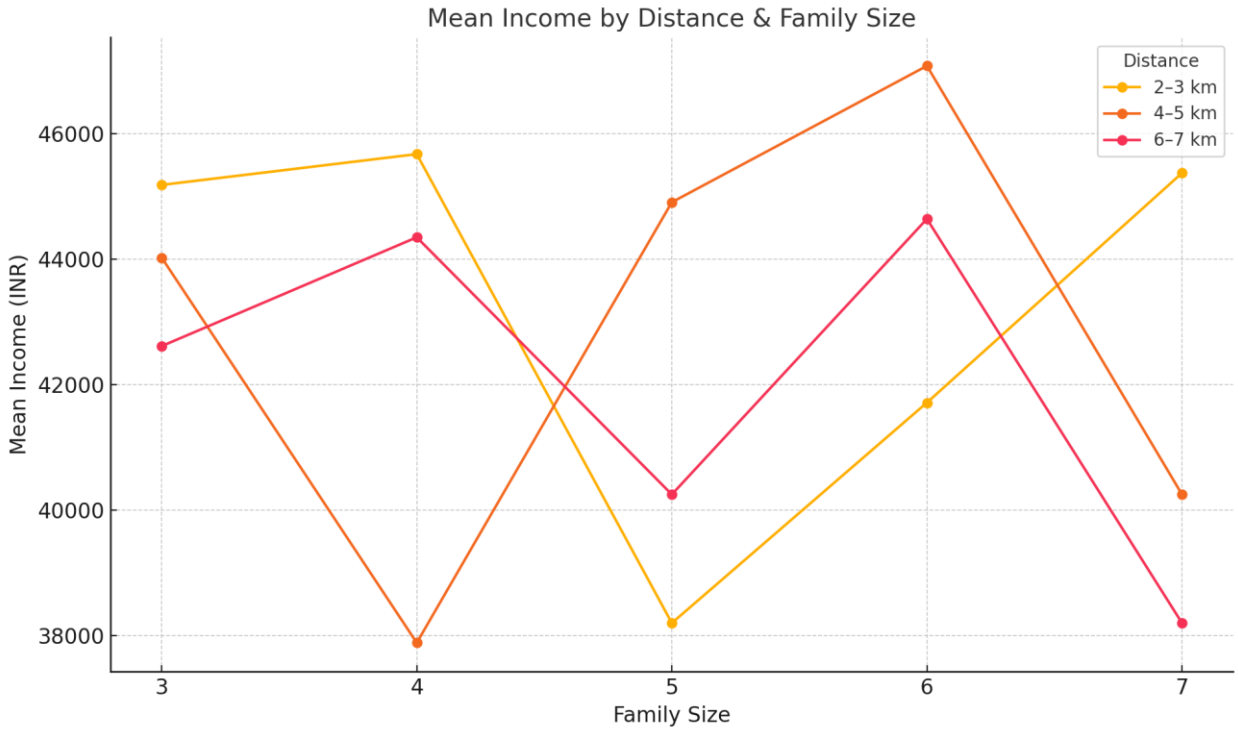

Figure 3: Mean Income by Distance & Family Size

4. Income Distribution by Education and Distance

Table 4 illustrates the impact of income on education vs distance. Secondary and Graduation and above levels yield the highest incomes overall, especially at closer distances (2–3 km). Illiterate's women surprisingly earn more than those with primary education particularly for 2–3 km and 4–5 km. Primary education shows the lowest mean income across all distances, suggesting limited economic uplift at this level. 2–3 km distance group consistently reports higher incomes at nearly all education levels. This trend supports the idea that proximity to markets positively influences earning potential. Income decreases as distance increases for Illiterate and Secondary groups, showing they may be more dependent on easy access to economic hubs. Figure 4.4 is the line chart visualizing X-axis represents Educational levels from Illiterate to Graduation and above and Y-axis is mean Income in INR. Each line represents a different distance range from the market. Individuals living 2–3 km from markets and with Secondary or Graduation+ education have the highest mean income (Rs. 50,500). Those with only Primary education earn the lowest on average, especially at farther distances.

Table 4: Mean Income by Distance and Educational Level

Distance	Educational Level				
	Illiterate	Primary	Secondary	High School	Graduation and above
2–3 km	45,944	40,933	50,500	42,565	50,500
4–5 km	44,643	40,789	43,667	41,714	42,300
6–7 km	41,038	43,667	40,853	42,300	43,667

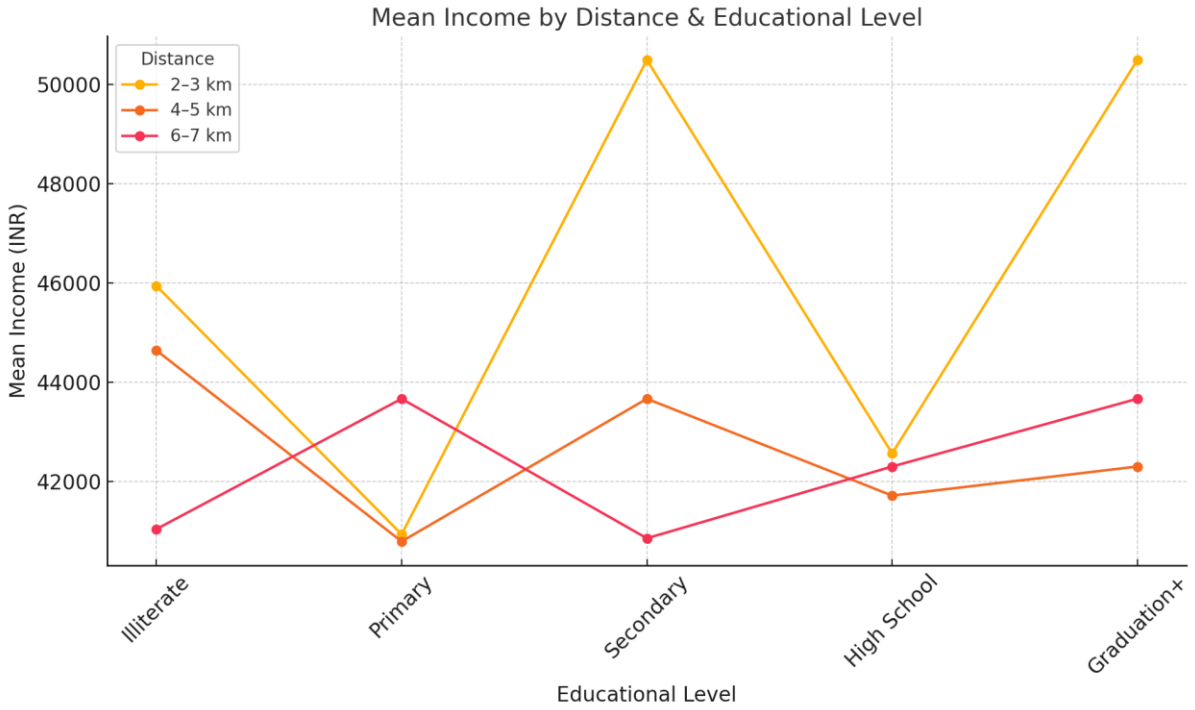

Figure 4: Mean Income by Distance and Education Level

DISCUSSION

- Married Women**:** This group consistently records stable incomes across all distance categories, with a peak income of Rs. 44,548 at 8–9 km. Their presence across all distance brackets suggests strong and widespread involvement in agricultural activities. This stability may reflect dual-income households, enhanced labor sharing, and better social acceptance of married women's economic roles.

- Unmarried Women**:** Their highest income (Rs. 50,500) is found closest to markets (2–4 km). However, income sharply declines with increased distance, highlighting their greater dependence on market accessibility. This group may face more mobility and social barriers in remote areas, restricting their economic engagement.
- Widows**:** Peak earnings (Rs. 47,083) occur at 2–3 km, but income drops significantly beyond this range, indicating vulnerability. Widows appear more economically marginalized, possibly due to limited support systems, restricted mobility, and social stigma, especially in distant areas.
- The 26–30 and 41–45 age groups consistently report the highest mean incomes, particularly at 2–3 km from the market (Rs. 47,938). These groups are typically in their most productive and physically active years, which may explain their strong economic performance.
- The 46–50 age group peaks unexpectedly at 4–5 km with an income of Rs. 45,676, suggesting that income does not necessarily decline with distance for all groups. This could reflect experience-based resilience and efficient resource use.
- Households located 2–3 km from markets show consistently higher average incomes across all family sizes (except 5-member families), suggesting that market proximity provides tangible income advantages regardless of household size.
- 6-member families at 4–5 km record the highest overall mean income (Rs. 47,083), indicating that certain medium-distance households may be strategically positioned in terms of labor availability and market access.
- 7-member families exhibit sharp income decline with increasing distance, reflecting the burden of more dependents without proportional income support or earning opportunities.
- Women with Secondary education and Graduation and above consistently earn the highest incomes, particularly within 2–3 km from market centers (Rs. 50,500 for both groups). This reflects the significant economic returns to higher education, especially when combined with strong market access.
- Surprisingly, illiterate women earn more than those with only Primary education, especially at 2–3 km and 4–5 km distances. This anomaly suggests that illiterate women may possess traditional agricultural skills, participate in collective farming, or benefit from local support systems despite lacking formal education.
- Primary-educated women show the lowest income across all distances, pointing to a potential "education trap" where minimal schooling does not significantly improve economic outcomes but may exclude them from traditional or community-based advantages.
- For most education levels, income declines as distance from the market increases, particularly for illiterate and secondary-educated women, indicating greater sensitivity to access issues.

CONCLUSION

Targeted support (e.g., mobile markets, subsidies, SHG involvement) should be designed for unmarried and widowed women, particularly in remote blocks. Investment in transport infrastructure and local market development in distant villages can significantly enhance income levels for marginalized groups. Marital status-sensitive programming in agricultural schemes (e.g., land leasing, credit access, capacity building) could bridge income disparities and promote inclusion. Youth-focused agricultural interventions (e.g., training, input support, entrepreneurship promotion) should be intensified near markets where their income potential is highest. Support systems for older women, such as accessible transport, collective

marketing platforms, and community labor-sharing models, can mitigate age-related disadvantages. Infrastructure and services at 4–5 km ranges may need assessment and improvement to reduce the income dip seen across age groups. Encouraging age-diverse participation through tailored schemes can help achieve more inclusive agricultural growth in tribal regions. Tailored interventions by family size can be more effective than one-size-fits-all programs. Larger families may need support in labor mobilization, childcare, and food security. Improve market access and transport infrastructure beyond the 3 km radius, especially targeting large households, to prevent income stagnation or decline. Income dips for 5- and 7-member families highlight potential gaps in employment, access to credit, or participation in government schemes — warranting deeper investigation and targeted livelihood support. Family-based labor programs or collective farming models can help optimize participation and income distribution across varied household sizes. Strengthen access to secondary and higher education for tribal women, especially in remote areas, to maximize income potential. Combine educational interventions with market linkages, ensuring that educated women have platforms to apply their knowledge (e.g., agri-business, cooperative leadership, extension services). Introduce bridging programs for women with primary education to enhance practical agricultural and entrepreneurial skills, thereby improving their income prospects. Recognize and leverage traditional knowledge systems among illiterate women, integrating them into formal training or extension models.

Declaration by Authors

Acknowledgement: None

Source of Funding: None

Conflict of Interest: No conflicts of interest declared.

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How to cite this article: Ranjuma Pradhan, Snigdharani Panda, Gouri Shankar Beriha, Bishnu Naik, Jeetendra Saraka. Contribution of tribal women farmers to the agricultural sector: a study of Kandhamal District. *International Journal of Research and Review*. 2025; 12(6): 704-711. DOI: *10.52403/ijrr.20250679*

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