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EFFECT OF INTEGRATED FARMING SYSTEM ON ECONOMIC EMPOWERMENT OF TRIBAL COMMUNITY : A META-ANALYSIS STUDY

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ABSTRACT

Traditional farming practices, based on cultural values and local knowledge, have the potential to significantly improve environmental sustainability and community resilience (Adefila *et al.,* 2024). Over centuries of growth, indigenous tribes have developed IAK, which combines traditional practices such as intercropping with agroforestry and organic pest management technologies to adapt to local conditions. The proper combination of IAK and modern scientific technology paves the way for an effective road to sustainable food production and food security systems. Precision farming and sensor technologies provide real-time insights into crop health, while organic farming practices prioritize ecological balance. The union of tradition and technology is transforming the agricultural landscape. These improvements are more than just modernization; they reflect a comprehensive approach to crop improvement that draws on the best of both past and present. To quantitatively assess the impact of Integrated Farming System with modern agricultural techniques on economic empowerment of tribal community, a meta-analysis was conducted using available studies from the region. Based on predefined inclusion and exclusion criteria, 30 studies were selected and analysed to derive robust and reliable conclusions. By examining traditional and modern agricultural practices within a sociocultural framework, this study investigates how integrated farming system effect the economic empowerment of tribal community.

Key words: Integrated Farming System, Economic Empowerment, Tribal Community.

Agriculture is the primary source of income for underprivileged groups in developing countries like India. Small and marginal farmers are the backbone of the agrarian rural economy in India, accounting for around 80% of the total agricultural community but owning only 36% of total operational landholdings. Tribal farmers, the disadvantaged segment, face compounded socioeconomic challenges, including geographic isolation, limited access to institutional credit, insufficient extension services, and an overreliance on subsistence-oriented monocropping systems that offer little resilience against climate or market shocks.

The Integrated Farming System (IFS) is a multidisciplinary, holistic approach to the structural restrictions that small and marginal farmers face.To address farming distress and overcome smallholder challenges, vertical intensification with diversification (IFS) has been identified as a viable solution. Environmental friendly and resource-efficient IFS models are critical for ensuring subsistence and food security for farmers with limited resources, promoting the steady advancement of the rural economy. Evidence is substantial across multiple studies. Swarnam *et al*. (2025) found that 20 tribal women beneficiaries increased household income by ₹ 15,000 annually, with economic empowerment indices rising from 0.088 to 0.437. Bhardwaj and Vyas (2015) documented that tribal adopters earned net returns of ₹ 5.30 lakh annually with a benefit-cost ratio of 4.38, generating 1,800 mandays of employment. Madhuprasad *et al*. (2024) tracked 242 respondents whose gross income increased from Rs. 12,062 to Rs. 118,564, yielding 3.41 rupees per rupee invested. Meshram (2024) studied 250 tribal farmers, confirming IFS provides year-round income and employment. Netam *et al*. (2019) reported annual net returns of Rs. 217,591 with 619 mandays generated. These studies collectively demonstrate consistent, quantifiable economic gains across diverse tribal regions in India.The present study undertakes a Meta-analysis of published research examining the effect of Integrated Farming Systems on the economic empowerment of tribal communities.

MATERIAL AND METHODS

Meta-analysis is the statistical method of analysing a large collection of results from individual

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studies (Borenstein *et al.* 2009).The samples were obtained by a comprehensive search of social science resources and academic archives. Relevant published M.Sc. and Ph.D. theses and research articles were identified using the keywords "Integrated Farming System," "Economic Empowerment," and "Tribal Community." 56 studies were initially retrieved. The studies were assessed and analysed using predetermined inclusion and exclusion criteria. After screening, 30 studies meeting the eligibility criteria were chosen for the final meta-analysis. The chosen studies established the database for further investigation. The results were interpreted using a forest plot diagram.An ex-post-facto research design was followed in the present investigation.The following table lists the selected studies, along with their authors, sample sizes, and the r values.

Table 1: Details of the selected studies

Author	Study	n	r
Pavankalyan (2013)	An Economic Analysis of Tribal Agriculture in Telangana Region of Andhra Pradesh	108	0.59
Nayak (2025)	Perception and Utilisation Pattern of Information And Communication Technologies (Icts) among Tribal Livestock Farmers of Telangana State	405	0.23
Mahesh (2016)	A Study on Sustainable Livelihoods of Tribal Farmers of Adilabad District of Telangana State	120	0.03
Srinivas, A (2016)	Seed Banking Behaviour of Tribal Farmers of the Andhra Pradesh State	240	0.48
Reddy (2022)	Indigenous and Modern Communication Systems among Tribal Farmers of Telangana: A Comparative Study	120	0.18
Thatikonda (2017)	A study on adaptive capacity and technologies adopted by farmers forclimate resilient agriculture in drought prone areas	240	0.32
Sharma (2022)	Impact of Farmer Producer Organization in Uplifting of Tribal Farmers of Telangana.	191	0.28
Deekshith (2025)	Study on Attracting and Retaining Youth in Agriculture (ARYA) Project on Livelihood Security for Youth in Nalgonda district of Telangana	160	0.35
Kailash (2010)	Study on information management behaviour of tribal farmers of Adilabad district in Andhra Pradesh	120	0.23
Sravyasree (2021)	Mapping of tribal products and assessing their market linkages in BhadradriKothagudam district of Telangana state	205	0.02
Manjunath (2018)	Food mapping: An analysis of food production and consumption pattern in nutritionally vulnerable community in Telangana	240	0.04
Ray (2022)	Attitude of paddy growers towards farm mechanization	120	0.21
Sandeep (2023)	Digital agricultural communication and services ecosystem in Telangana an analysis	180	-0.74
Lalitha (2015)	Development of multimedia module for effective domestic water sanitation-an experimental study in tribal area	60	0.03
Badhulal (1999)	An analysis of dairy farming practices among the tribal farmers of Khammam district of Andhra Pradesh	120	0.41
Rao (2013)	A study on sheep farming practices among the tribal farmers in Srikakulam district	120	0.28

Author	Study	n	r
Sadvi (2015)	A study on adoption of hybrid rice seed production in Karimnagar district of Telangana state	120	0.19
Reddy (2005)	Socio-economic and cultural implications of coffee cultivation among tribals in the eastern ghats of Andhra Pradesh	200	0.45
Kumari (2020)	Economic analysis of livestock-based farming systems in tribal areas of Odisha	240	0.08
Ramya Sri (2017)	Economics of dairy farming of small and marginal farms in Khammam district of Telangana state	90	-0.25
Meshram (2020)	Integrated Farming System for Sustainable Livelihood Security of the Small and Marginal Tribal Farmers of Mandla District of MP	250	0.48
Mahammadhusen (2014)	Economic analysis of maize based farming system in the tribal area of central Gujarat	120	0.43
Raojibhai (2011)	An impact analysis of peasantry modernization in agriculture under integratedtribal development project of Vadodara district	240	0.03
Patel (2005)	Peasantry modernization in integrated tribal development project area of dahod district of Gujarat state	200	0.05
Singh (2021)	Scientisation of indigenous technical knowledge of tribal farmers in Ranchi district of Jharkhand	120	0.65
Ranganatha (2002)	Identification of indigenous farm practices followed by Soliga tribals	240	0.21
Dash (2019)	Training needs of tribal youth in selected agricultural enterprises: an analytical study in Odisha state, India	246	0.27
Malhotra (2007)	Effectiveness of Integrated Village Development Project in transfer of animal husbandry practices among tribal farmers of Kotra tehsil in Udaipur District	120	0.44
Bhattacharjee (2016)	A micro-level study on dimensions of emerging livelihood pattern of srural tribal youth in Tripura	120	0.52
Nirmalkumar (2013)	Adoption of no-cost and low-cost technologies of watershed management by tribal farmers	120	0.22

RESULTS AND DISCUSSION

The main outcome of any meta-analysis is a forest plot. The x-axis forms the effect size scale, plotted on the top of the plot. Each row, except the bottom one, represents a study's effect size estimate in the form of a point and a (95%) confidence interval. The point estimate is represented in the forest plot by a smaller or a larger bullet. The relative size of these bullets represents a study's weight in the generation of the meta-analytic result

According to Cohen's (1992) some confidence intervals are entirely on the positive side of zero,demonstrating that the Integrated Farming System had a statistically significant positive impact on economic empowerment. These data indicate that the implementation of IFS significantly improves household income, employment possibilities, livelihood security, savings, and overall economic stability among tribal households.However, the confidence intervals for the 13th and 20th studies were totally on the negative side of zero, indicating statistically significant negative impacts. These inconsistent findings could be attributed to region-specific restrictions such as a lack of technical knowledge, insufficient institutional support, poor market access, restricted irrigation infrastructure, a scarcity of resources, or inappropriate farming

component implementation. The unfavourable findings in these studies suggest that the success of an Integrated Farming System is heavily influenced by local socioeconomic and environmental variables.

Furthermore, the confidence intervals of some studies crossed zero, indicating statistically insignificant effects. These findings indicate that, while the Integrated Farming System may have demonstrated positive trends in some areas, the quantity of change was insufficient to establish statistical significance. Inconsistencies may develop as a result of small sample sizes, short intervention durations, variances in farming models, or disparities in measuring economic empowerment indicators.Most of the studies stressed the need of training for farmers. The most significant obstacle faced by tribal farmers was a lack of information on improved agricultural techniques, defective and inaccurate weighing practices in markets, a lack of appropriate storage facilities, elevated seed expenses, and high marketing expenditures (Pavankalyan 2013). Farmers also reported high interest rates paid by private firms and bank loan approval delays as severe credit limitations. Furthermore, key problems were recognized as high labour expenses, poor marketing facilities, low government assistance prices, and family financial crises. The government should implement appropriate interventions and inclusive policies to promote integrated farming and other modern agricultural practices among tribal communities.

The overall meta-analytic effect shown in Figure 1 did not include zero within the 95 per cent confidence interval. This indicates that the p-value was less than 0.05, confirming that the combined effect of Integrated Farming System on economic empowerment was statistically significant. Therefore, the null hypothesis of no effect can be rejected, and it can be concluded that Integrated Farming System plays a significant role in enhancing the economic conditions of tribal communities.

The set of studies undertaken in a field of study is likely to be biased in many ways. One form of selection bias that might be detected in the meta-analysis itself is publication bias. It makes sense only in a homogeneous set of results in which the combined effect size can be interpreted as an estimate of a true effect size in the population. The funnel plot indicates there is no asymmetry in the distribution of effect sizes *i.e.*, the data is homogeneous in nature.

Figure 1. Forest Plot Diagram

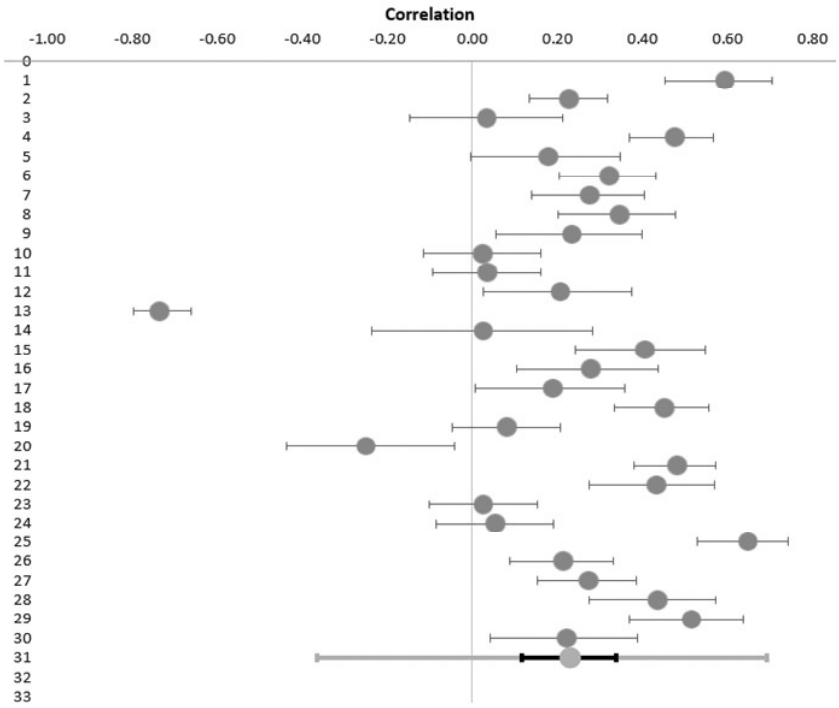
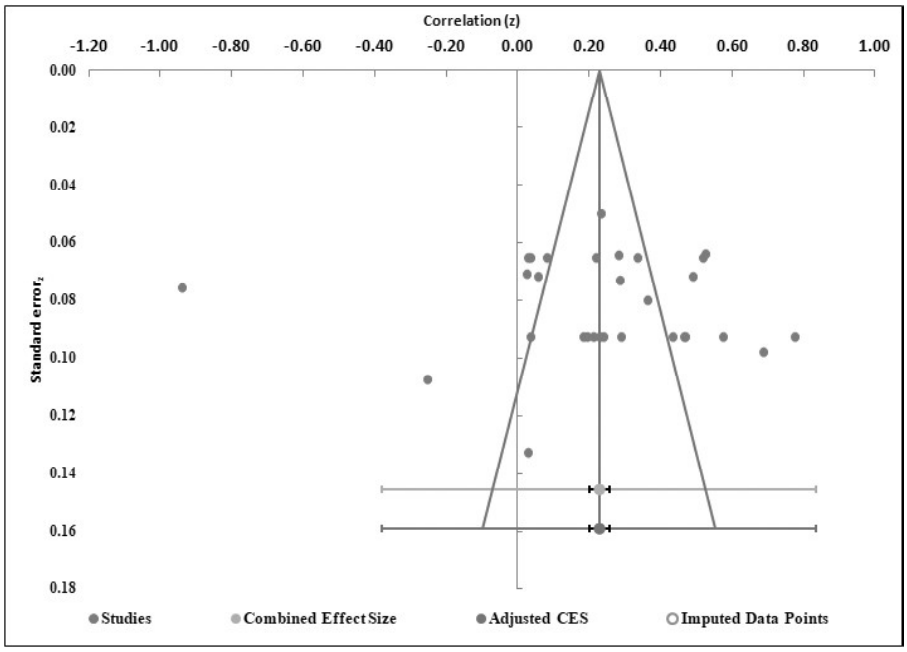


Figure 2. Funnel plot



CONCLUSION

The study concludes that the Integrated Farming System contributes to a great extent to the economic empowerment of tribal communities. The results of the meta-analysis summarize 30 studies in the domain. The forest plot diagram shows that most of the studies have a statistically significant positive effect with low heterogeneity.The findings of the study support the argument that Integrated Farming System promotes diversified income generation and efficient utilization of farm resources. By integrating enterprises such as crop production, livestock, fisheries, poultry, agroforestry, and allied activities, tribal farmers can reduce risk, ensure year-round employment, and improve livelihood resilience. The system also enhances sustainability through recycling of farm waste and better utilization of available resources, thereby contributing to long-term economic empowerment.

Overall, the meta-analysis provides solid empirical evidence that the Integrated Farming System is a successful technique for increasing tribal communities' economic empowerment. The study emphasizes the importance of policy interventions, extension support, skill training, financial aid, and market linkages in maximizing the benefits of Integrated Farming Systems for tribal populations.

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