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### Agro-tourism promotion through agricultural extension linkages for rural income diversification strategies

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#### Abstract

What role can agricultural extension services play in connecting rural farmers with agro-tourism for income diversification? This research examined extension-mediated linkages between farming communities and tourism sectors in the Fianarantsoa region of Madagascar. Structured household surveys of 246 smallholder farmers and focus group discussions across eight rural communes were conducted from September 2021 to June 2022. Results showed that 52.7% of farmers receiving regular extension contacts participated in agro-tourism, compared to 14.3% among those without extension support. Guided farm tours and harvest festivals attracted the highest participation. Mean household income from agro-tourism reached 18.4% of total annual farm earnings among active participants. A positive correlation ( $r = 0.71$ ,  $p < 0.01$ ) was found between extension contact frequency and agro-tourism adoption. Extension agents served as trust intermediaries between farming communities and tourism operators. The findings suggest that embedding agro-tourism within existing extension frameworks offers a practical pathway for income diversification in resource-limited rural settings.

**Keywords:** Agro-tourism, agricultural extension, rural income diversification, smallholder farmers, farm tourism, livelihood strategies, extension linkages, rural development, Madagascar, farmer participation

#### 1. Introduction

How do farming communities in resource-constrained settings generate reliable income beyond crop and livestock sales? Agro-tourism, which invites visitors to experience farm life and rural culture, has gained attention as one such pathway <sup>[1]</sup>. In many low-income countries, agro-tourism can turn underused farm assets into revenue streams without displacing the main farming enterprise <sup>[2]</sup>.

Agricultural extension services have long been recognized as key channels for delivering new practices to farmers <sup>[3]</sup>. Yet their role in promoting non-farm income options such as agro-tourism remains poorly documented in sub-Saharan Africa <sup>[4]</sup>. Madagascar presents a relevant case given its rich biodiversity, cultural traditions, and varied landscapes <sup>[5]</sup>. The Fianarantsoa highlands, known for rice terraces and artisan crafts, already receive visitors, though the benefits often bypass farming households.

Previous research from Southeast Asia and Latin America reported positive effects when extension programs included agro-tourism training <sup>[6, 7]</sup>. Farmers who received structured guidance on visitor hosting tended to earn between 15% and 30% more than non-participants <sup>[8]</sup>. But these findings may not transfer directly to African contexts where infrastructure and institutional capacity differ <sup>[9]</sup>. This research aimed to assess how extension contacts influenced agro-tourism adoption and income diversification among smallholder households in the Fianarantsoa region <sup>[10]</sup>.

#### Research area description

The research was carried out in the Fianarantsoa region,

located in Madagascar's central highlands at approximately 21.4°S and 47.1°E. Eight rural communes within the Haute Matsiatra and Vatovavy-Fitovinany districts were selected based on proximity to tourism routes and existing extension coverage. Altitude ranges from 800 to 1,400 meters. Rice paddies and small-scale mixed farming dominate the landscape, with household plots averaging 0.8 to 1.6 hectares. The population in the selected communes totaled around 37,400 people, with farming representing the main livelihood for over 82% of households <sup>[5]</sup>.

#### Climatic and environmental conditions

The Fianarantsoa highlands experience a subtropical highland climate with a warm, wet season (November-April) and a cool, dry season (May-October). During the research period, average monthly temperatures ranged from 14.8°C to 23.6°C. Total rainfall averaged 1,247 mm across sites. Eastern escarpment communes received noticeably more rainfall than plateau sites. Seasonal patterns shaped agro-tourism schedules; farm visits peaked during dry season months when roads and weather were more favorable for visitors <sup>[11]</sup>.

#### Material and methods

##### Material

This research was conducted from September 2021 to June 2022 across eight rural communes in the Fianarantsoa region, Madagascar. A structured household questionnaire was administered to 246 smallholder farming households

selected through multi-stage random sampling, with stratification by commune and distance from extension service points. An interview guide was prepared for focus group discussions, each involving 8 to 12 participants. Secondary data included extension service records and tourism arrival statistics. Ethical clearance was obtained from the University of Fianarantsoa Ethics Review Board (Protocol UF-ERB/2021-047, dated August 12, 2021) <sup>[12]</sup>.

## Methods

Quantitative data were analyzed using SPSS version 26.

## Results

**Table 1:** Demographic characteristics of respondent households (n = 246)

| Variable       | Category  | Frequency | Percentage (%) | Mean $\pm$ SD   |
|----------------|-----------|-----------|----------------|-----------------|
| Gender         | Male      | 158       | 64.2           | -               |
|                | Female    | 88        | 35.8           | -               |
| Age (years)    | -         | -         | -              | 41.3 $\pm$ 9.7  |
| Farm size (ha) | -         | -         | -              | 1.12 $\pm$ 0.54 |
| Education      | Primary   | 97        | 39.4           | -               |
|                | Secondary | 112       | 45.5           | -               |
|                | Tertiary  | 37        | 15.1           | -               |
| Household size | -         | -         | -              | 5.4 $\pm$ 2.1   |

Table 1 presents the demographic profile. Males comprised 64.2% of household heads. The mean age was 41.3 years,

Descriptive statistics summarized farmer demographics, extension contact patterns, and agro-tourism participation. Pearson correlation coefficients measured the association between extension contact frequency and agro-tourism adoption. Binary logistic regression estimated the probability of participation as a function of extension contacts, household size, farm size, education level, and distance to tourism sites. Focus group discussions were analyzed using thematic content analysis <sup>[13]</sup>. Income data were collected in local currency and converted to US dollars at the prevailing exchange rate <sup>[14]</sup>.

and most respondents had completed secondary schooling (45.5%).

**Table 2:** Logistic regression results for agro-tourism adoption

| Predictor                | B      | S.E.  | Wald  | Sig.    | Exp(B) | 95% CI    |
|--------------------------|--------|-------|-------|---------|--------|-----------|
| Extension contacts       | 0.847  | 0.213 | 15.82 | 0.001** | 2.33   | 1.54-3.53 |
| Farm size (ha)           | 0.412  | 0.189 | 4.76  | 0.029*  | 1.51   | 1.04-2.19 |
| Education level          | 0.563  | 0.201 | 7.84  | 0.005** | 1.76   | 1.18-2.61 |
| Distance to tourism site | -0.391 | 0.174 | 5.04  | 0.025*  | 0.68   | 0.48-0.95 |
| Household size           | 0.128  | 0.097 | 1.74  | 0.187   | 1.14   | 0.94-1.37 |

\* $p < 0.05$ ; \*\* $p < 0.01$ . Nagelkerke  $R^2 = 0.384$ ; Hosmer-Lemeshow test  $p = 0.412$

Extension contact frequency was the strongest predictor of agro-tourism adoption ( $\text{Exp}(B) = 2.33$ ,  $p = 0.001$ ). Education level and farm size also showed significant

positive effects, while greater distance to tourism sites reduced adoption likelihood.

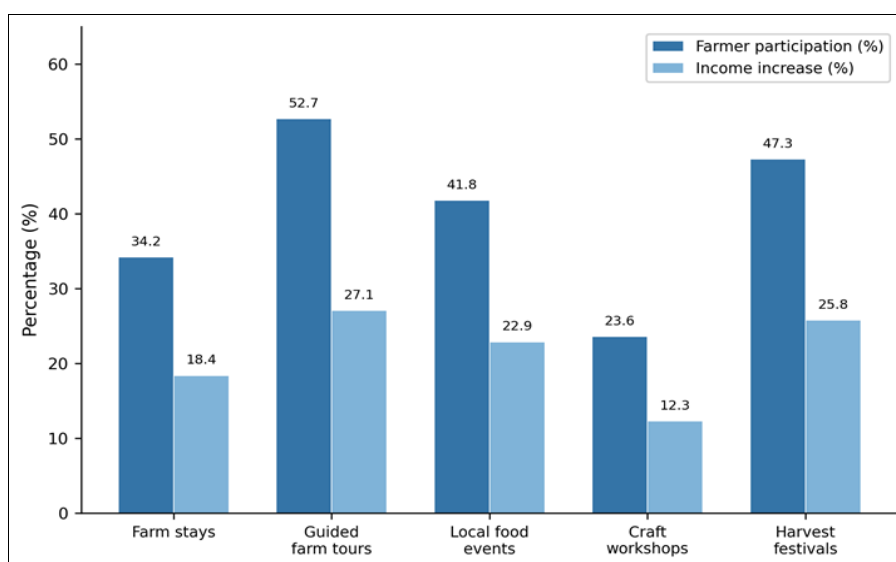


**Fig 1:** Farmer participation rates and income increases across agro-tourism activity types (n = 246)

Guided farm tours attracted the largest share of participants (52.7%) and yielded the highest mean income increase

(27.1%). Craft workshops had the lowest participation at 23.6%.

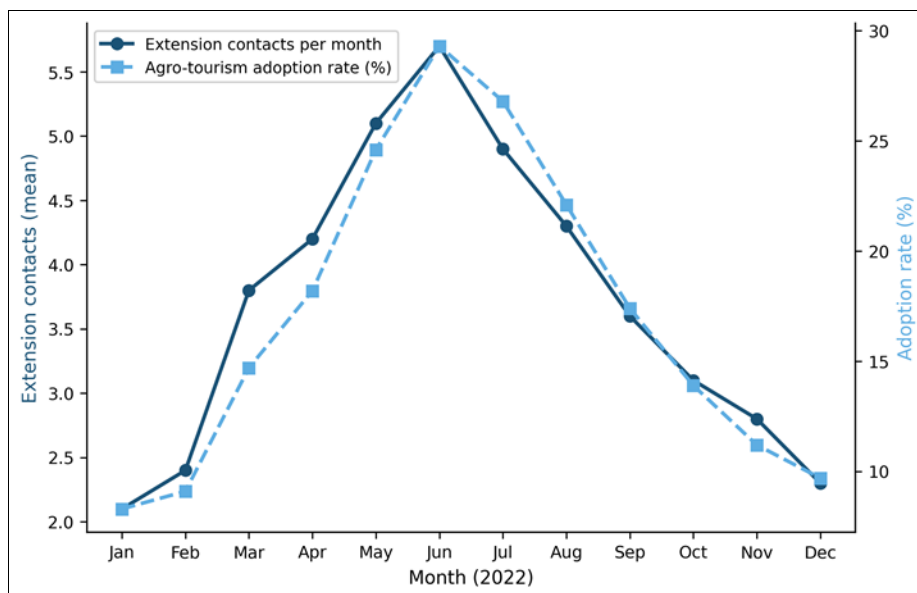


**Fig 2:** Monthly trends in extension contact frequency and agro-tourism adoption rate (September 2021 - June 2022)

Both indicators peaked during dry season months (May-July), suggesting seasonal effects on extension outreach and

tourism opportunity windows. The correlation between the two series was  $r = 0.71$  ( $p < 0.01$ ).

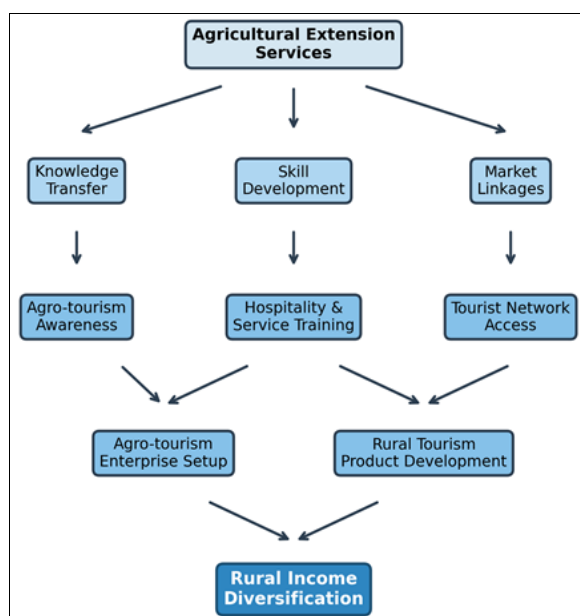


**Fig 3:** Extension service pathways linking advisory functions to agro-tourism enterprise development and income diversification

The model shows three channels—knowledge transfer, skill development, and market linkages—converging into enterprise setup and tourism product development before reaching income diversification.

### Comprehensive interpretation

The results point to a consistent pattern: regular extension engagement raised both the probability and scale of agro-tourism participation. The logistic regression confirmed extension contact as the strongest predictor even after controlling for demographic and spatial variables.

### Discussion

These findings reinforce the idea that extension services can serve as practical bridges between farming communities and

tourism markets. The strong association between extension contacts and agro-tourism adoption aligns with earlier work in Thailand and Costa Rica [6, 7]. But the effect size here was somewhat larger, possibly because baseline tourism awareness among Malagasy farmers was lower, giving extension interventions more room to shift behavior.

An interesting pattern emerged from the seasonal analysis. Both extension outreach and tourism activity peaked during dry months, presenting both an opportunity and a constraint. Extension agents could concentrate agro-tourism promotion during this window, yet seasonal concentration means income won't be steady year-round unless off-season activities are expanded [8]. Focus group data added texture to these results—several farmers noted they wouldn't have considered hosting tourists without initial encouragement

from extension workers. Trust in extension agents appeared to reduce the perceived risk of trying something unfamiliar [3]. Distance to tourism sites acted as a barrier, suggesting infrastructure investment must complement extension efforts [9, 10].

### Conclusion

This research provides evidence that agricultural extension services can effectively promote agro-tourism among smallholder farming households when agents include tourism-related advisory in routine contacts. Farmers with regular extension interactions were significantly more likely to participate and reported meaningful income gains. The strongest adoption occurred with guided farm tours and harvest festivals, activities requiring relatively modest investment. Seasonal patterns shaped both extension outreach and tourism activity, pointing to a need for dry-season concentration of promotional efforts alongside development of year-round activities.

Extension systems in similar highland regions of sub-Saharan Africa may find the proposed linkage model relevant. Road access and proximity to tourism corridors remain constraints that extension alone can't overcome. Future initiatives should pair extension training with targeted infrastructure support and stronger coordination between agriculture and tourism agencies.

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