

Socioeconomic Impacts of Vegetable Farming under Community-Based Resource Management in Maroamalo, Southwestern Madagascar

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Abstract

This study aims to analyze the socioeconomic impacts of vegetable farming under community-based resource management in Maroamalo, Southwestern Madagascar. Vegetable farming has emerged as a major income-generating activity promoted by the Soamanampy Vondron'Olona Ifotony (VOI) within the framework of natural resource management transfer. A mixed-methods case study approach was employed, combining household surveys, semi-structured interviews, focus group discussions, field observations, and secondary data analysis. Quantitative data were analyzed using descriptive statistics and value-chain assessment, while qualitative information was examined through thematic content analysis. The results show that vegetable farming occupies 15.71 ha and generates an annual production of 1,645.94 tons, primarily consisting of eggplant, pepper, fotsivody, kimalao, and tomato. Most production (80%) is marketed in Toliara, demonstrating strong integration into regional markets. The annual economic value of production was estimated at 1.08 billion Ariary, with producers capturing approximately 62% of the generated value. In addition to improving household income, vegetable farming creates employment opportunities and supports several actors along the value chain, including transporters, traders, and intermediaries. Survey findings further indicate that local communities perceive vegetable farming as a viable alternative to environmentally destructive activities such as charcoal production and forest clearing. Most respondents reported positive contributions of the activity to biodiversity conservation and community-based resource management. The study concludes that vegetable farming plays a significant role in strengthening rural livelihoods while supporting conservation objectives. Promoting sustainable agricultural practices and improving market access could further enhance the contribution of vegetable farming to rural development and environmental sustainability in community-managed landscapes.

Keywords: *Socioeconomic; Farming; Management; Maroamalo, Madagascar*

Introduction

The conservation of natural resources and biodiversity has become a major global concern due to increasing anthropogenic pressures on ecosystems (Andriamparany et al., 2021). Deforestation, unsustainable resource extraction, agricultural expansion, wildfires, and persistent rural poverty continue to threaten ecological integrity, particularly in developing countries where local livelihoods depend heavily on natural resources (Davis et al., 2024). Traditional conservation approaches based solely on centralized control have often proved insufficient in addressing these challenges (Donatti et al., 2025). Consequently,

participatory and community-based natural resource management approaches have gained increasing recognition as viable alternatives for achieving both environmental conservation and socioeconomic development. According to Ostrom (1990), local communities can effectively manage common-pool resources when they possess clearly defined rights, locally adapted rules, and functioning governance institutions.

The theoretical foundation of Community-Based Resource Management (CBRM) is rooted primarily in Common-Pool Resource Theory and Collective Action Theory, which emphasize the capacity of local institutions to govern natural resources sustainably through locally developed rules, monitoring systems, and collective participation (Ostrom, 1990). Under this perspective, conservation outcomes are more likely to be achieved when communities perceive tangible benefits from resource management and actively participate in decision-making processes. Complementing this perspective, the Sustainable Livelihoods Framework (Scoones, 1998; DFID, 1999) argues that households diversify their livelihood strategies by mobilizing available assets to improve income, reduce vulnerability, and enhance long-term well-being. Within community-managed landscapes, livelihood diversification through income-generating activities may reduce dependence on environmentally destructive practices while simultaneously strengthening incentives for conservation. These theoretical perspectives suggest that successful CBRM depends not only on institutional arrangements but also on the availability of economically viable livelihood alternatives capable of aligning local welfare objectives with conservation goals.

Across Africa and other developing regions, community-based natural resource management has emerged as a strategy to reconcile conservation objectives with local livelihood needs (Eric et al., 2026). Rural populations frequently rely on forests, agricultural lands, water resources, and other ecosystem services for their subsistence and income generation (Dorothé, 2024). Therefore, conservation initiatives that fail to address local economic realities often encounter limited success. Several studies have demonstrated that income-generating activities can reduce local dependence on environmentally destructive practices while simultaneously improving household welfare (Agrawal & Gibson, 1999; Ribot, 2002). In this context, sustainable livelihood diversification has become an essential component of community-based conservation programs (Berkes, 2004).

In Madagascar, community participation in natural resource management has been institutionalized through the Transfer of Natural Resource Management (TNRM) framework. This framework is implemented primarily through the Gestion Locale Sécurisée (GELOSE) and Gestion Contractualisée des Forêts (GCF) mechanisms, which transfer specific management responsibilities from the state to local communities organized as Vondron'Olona Ifotony (VOI). These mechanisms seek to strengthen local governance, promote sustainable resource use, reduce environmental degradation, and improve the livelihoods of rural populations (Elaniriko, 2023). From the perspective of Common-Pool Resource Theory, VOIs function as local governance institutions responsible for establishing and enforcing rules governing resource use. Simultaneously, the Sustainable Livelihoods Framework suggests that the effectiveness of these institutions depends partly on their ability to support livelihood opportunities that reduce reliance on unsustainable resource extraction. However, the effectiveness of community-based management systems varies considerably depending on institutional capacity, community engagement, external support, and the availability of economically viable livelihood alternatives (Rasolofoson et al., 2015; Gardner et al., 2018).

Southwestern Madagascar represents one of the country's most ecologically distinctive yet environmentally vulnerable regions (Eric et al., 2025b). The Atsimo-Andrefana Region is characterized by semi-arid climatic conditions, unique dry forest ecosystems, and high levels of biodiversity endemism. Despite their ecological importance, these ecosystems face increasing pressure from charcoal production, uncontrolled wood harvesting, slash-and-burn agriculture, recurrent fires, and widespread rural poverty (Randriamanantena, 2020).

Within this context, the Amoron'i Onilahy Protected Area serves as a critical conservation landscape. Nevertheless, conservation efforts remain challenged by the continued socioeconomic dependence of local communities on natural resource exploitation (Rakotovao et al., 2025). This situation reflects a fundamental challenge frequently identified in the CBRM literature: conservation objectives cannot be sustained in the long term if local communities lack alternative livelihood opportunities capable of meeting household economic needs (Fabricius et al., 2004; Berkes, 2004). Consequently, identifying sustainable income-generating activities capable of reducing environmental pressures while enhancing rural livelihoods has become a major development priority.

One such activity is vegetable farming, which has gained increasing importance among rural households in the Maroamalo village of Ambohimahavelona Rural Municipality, located within the lower Onilahy River basin. Supported by the Soamanampy VOI under the community-based resource management framework, vegetable farming has emerged as a significant source of income, food security, and employment for local households. The activity involves the cultivation of several market-oriented vegetable crops and contributes to the economic integration of Maroamalo with surrounding markets, particularly Ambohimahavelona and the regional capital of Toliara. Beyond its direct economic benefits, vegetable farming is increasingly perceived as an alternative livelihood strategy capable of reducing local dependence on environmentally harmful activities such as charcoal production, forest clearing, and unsustainable wood extraction (Ramahaimandimby & Sakurai, 2021). From a Sustainable Livelihoods perspective, vegetable farming represents a diversification strategy that may strengthen household resilience and economic security, while from a CBRM perspective it may provide incentives that encourage participation in conservation activities and compliance with community resource management rules.

Previous studies conducted in Madagascar have extensively examined community-based conservation, forest governance, and rural livelihoods. Gardner et al. (2016) highlighted the relationship between rural poverty and charcoal production in southwestern Madagascar, demonstrating how limited livelihood opportunities encourage environmentally destructive resource exploitation. Similarly, Rasolofoson et al. (2015) found that the success of community forest management initiatives depends heavily on local socioeconomic conditions and institutional effectiveness. Gardner et al. (2018) and Mdlalose et al. (2021) further emphasized that conservation outcomes are strongly influenced by governance quality and the extent to which local development needs are incorporated into conservation strategies. While these studies provide valuable insights into the interactions between conservation and livelihoods, relatively few investigations have specifically assessed the socioeconomic contribution of vegetable farming within the framework of community-based resource management in Madagascar.

Moreover, existing studies have largely focused on forest governance, biodiversity conservation, institutional arrangements, and policy implementation, often overlooking the economic performance of specific livelihood activities designed to support conservation objectives. Consequently, limited empirical evidence exists regarding how agricultural income-generating activities contribute simultaneously to household income, employment generation, food security, market integration, and the reduction of environmental pressures within community-managed landscapes. This gap is particularly significant because both Common-Pool Resource Theory and the Sustainable Livelihoods Framework suggest that successful conservation depends on the interaction between institutional effectiveness and livelihood opportunities. Therefore, an important knowledge gap remains concerning the extent to which vegetable farming functions as a practical mechanism linking rural development and community-based conservation in Madagascar.

The case of Maroamalo offers a particularly relevant context for addressing this gap. Under the management framework established by the Soamanampy VOI, vegetable farming has expanded considerably and now constitutes a major livelihood activity for local

households. The production system involves multiple stakeholders, including producers, irrigators, traders, transporters, and intermediaries. In addition to generating substantial economic value, the activity is believed by local communities to contribute indirectly to conservation by providing alternative income opportunities that reduce reliance on natural resource extraction (Bell et al., 2023). Nevertheless, the actual magnitude of these socioeconomic benefits and their implications for conservation outcomes have not yet been systematically documented and analyzed.

Understanding the socioeconomic impacts of vegetable farming is important both academically and practically. Academically, the study contributes to the growing literature on Community-Based Resource Management by integrating insights from Common-Pool Resource Theory and the Sustainable Livelihoods Framework to examine the relationship between livelihood improvement and conservation outcomes. Practically, the findings provide evidence that may assist policymakers, conservation organizations, local governments, and community institutions in designing livelihood interventions capable of simultaneously supporting rural development and biodiversity conservation. The results may also inform future strategies aimed at strengthening sustainable livelihoods in ecologically sensitive landscapes of Madagascar and other developing countries facing similar conservation challenges.

This study therefore seeks to analyze the socioeconomic impacts of vegetable farming as an income-generating activity within the framework of community-based resource management in Maroamalo, Southwestern Madagascar. Specifically, the study aims to examine the organization and functioning of the vegetable farming value chain, evaluate its contribution to household livelihoods and local economic development, and assess its perceived role in reducing pressures on natural resources and supporting community conservation efforts.

Methodology

This study used a mixed-methods approach using an explanatory sequential design following the framework proposed by Creswell and Plano Clark (2018). In this design, quantitative data were collected and analyzed first to assess the production, economic value, and livelihood contribution of vegetable farming. Subsequently, qualitative data were gathered to explain and contextualize the quantitative findings, particularly regarding local perceptions of conservation outcomes and community-based resource management. The integration of quantitative and qualitative evidence enabled a more comprehensive understanding of the socioeconomic and environmental implications of vegetable farming within the Soamanampy VOI management system.

Primary data were collected through household surveys, semi-structured interviews, focus group discussions, and direct field observations conducted among stakeholders involved in the vegetable farming value chain. The respondents included vegetable producers, traders, transporters, irrigators, village leaders, members of the Soamanampy VOI, and representatives of local institutions. Household surveys were used during the quantitative phase to collect information on cultivated areas, production volumes, market destinations, production costs, revenues, labor use, and household participation in vegetable farming activities. During the qualitative phase, semi-structured interviews and focus group discussions were conducted to explore local perceptions of livelihood improvement, market organization, resource management, and the contribution of vegetable farming to conservation efforts.

Secondary data were obtained from reports produced by the Soamanampy VOI, conservation and development partners, municipal records, and relevant scientific literature concerning community-based resource management and rural livelihoods in Madagascar. Quantitative data were analyzed using descriptive statistical techniques, including frequencies, percentages, averages, production estimates, and value-chain calculations. The

economic value of vegetable production was estimated using farm-gate prices reported by producers during the survey period. The distribution of economic benefits among actors was assessed through estimates of net producer income, labor contributions, production inputs, transportation margins, and intermediary gains. Qualitative information collected through interviews and focus group discussions was analyzed using thematic content analysis to identify recurring patterns related to socioeconomic benefits, livelihood diversification, conservation outcomes, and local resource governance.

Data integration was conducted during the interpretation stage. Quantitative findings concerning production performance, income generation, and value-chain dynamics were compared and complemented with qualitative evidence obtained from interviews, focus group discussions, and field observations. This triangulation process enhanced the validity of the findings and provided deeper insights into the relationships between vegetable farming, livelihood improvement, and community-based conservation.

The analysis focused on three main dimensions: (1) the structure and performance of vegetable farming production and marketing systems, (2) the socioeconomic contribution of vegetable farming to household livelihoods and local economic development, and (3) the perceived contribution of vegetable farming to community-based conservation and resource management. To guide the investigation, two research hypotheses were examined. The first hypothesis posited that vegetable farming significantly improves household livelihoods through income generation, employment creation, food security enhancement, and livelihood diversification. The second hypothesis proposed that vegetable farming contributes to reducing pressures on natural resources by providing an economically viable alternative to environmentally destructive activities. The findings were interpreted within the broader theoretical perspectives of the Sustainable Livelihoods Framework and Community-Based Resource Management.

Results and Discussion

Results

Vegetable Farming Production and Marketing System in Maroamalo

Vegetable farming constitutes one of the principal income-generating activities practiced by households in Maroamalo under the community-based resource management framework implemented by the Soamanampy VOI. The production system is based on irrigated cultivation along the Onilahy River and involves several actors, including producers, irrigators, traders, transporters, pesticide applicators, and intermediaries. Women play a dominant role in production and marketing activities, whereas men are more involved in transportation and phytosanitary treatments.

The total cultivated area devoted to vegetable production was estimated at 15.71 ha. Five main vegetable crops were identified: eggplant (baranjely), pepper (poivron), fotsivody, kimalao, and tomato (tamatesy). Eggplant and fotsivody occupied the largest share of cultivated land.

Table 1. Distribution of Vegetable Crops by Cultivated Area

Crop	Area (ha)	Share (%)
Eggplant (Baranjely)	5.42	34.5
Fotsivody	3.58	22.8
Pepper (Poivron)	2.81	17.9
Kimalao	2.37	15.1
Tomato (Tamatesy)	1.53	9.7
Total	15.71	100.0

Vegetable production occurs throughout most of the year, with production levels varying according to climatic conditions and water availability. Two production periods

were identified: a high-production period and a low-production period. The annual production was estimated at 1,645.94 t, of which 83.2% was produced during the high-production period and 16.8% during the low-production period.

Table 2. Annual Vegetable Production by Production Period

Production Period	Quantity (t)	Share (%)
High-production period	1,369.57	83.2
Low-production period	276.37	16.8
Total	1,645.94	100.0

Among the crops produced, eggplant represented the largest share of total production, followed by pepper, fotsivody, kimalao, and tomato.

Table 3. Annual Production by Crop

Crop	Production (t)	Share (%)
Eggplant (Baranjely)	554.45	33.7
Pepper (Poivron)	478.23	29.1
Fotsivody	318.12	19.3
Kimalao	252.14	15.3
Tomato (Tamatesy)	43.00	2.6
Total	1,645.94	100.0

The marketing system revealed strong commercial linkages between Maroamalo, Ambohimahavelona, and Toliara. Most production was sold outside the village, particularly in the urban market of Toliara.

Table 4. Destination of Vegetable Products from Maroamalo

Destination	Share (%)	Estimated Quantity (t)
Maroamalo	8	131.68
Ambohimahavelona	12	197.51
Toliara	80	1,316.75
Total	100	1,645.94

Transportation was mainly conducted by bicycle (72%), followed by carts (22%) and other means of transport (6%). Two major marketing channels were identified: direct sales from producers to traders in Toliara (68%) and sales through intermediaries or sub-collectors (32%).

Socioeconomic Contribution of Vegetable Farming

The annual economic value of vegetable production at farm-gate prices was estimated at 1,077,700,444 Ariary. The high-production period generated 568,428,000 Ariary (52.7%), while the low-production period generated 509,272,444 Ariary (47.3%).

Table 5. Economic Value of Vegetable Production at Farm-Gate Prices

Crop	High Production (Ar)	Low Production (Ar)	Annual Value (Ar)	Share (%)
Pepper	187,600,000	247,272,000	434,872,000	40.4
Fotsivody	80,400,000	90,216,000	170,616,000	15.8
Kimalao	93,800,000	116,172,000	209,972,000	19.5
Eggplant	196,980,000	42,604,444	239,584,444	22.2
Tomato	9,648,000	13,008,000	22,656,000	2.1
Total	568,428,000	509,272,444	1,077,700,444	100.0

Pepper represented the largest share of total economic value, accounting for 40.4% of annual revenue, followed by eggplant (22.2%), kimalao (19.5%), fotsivody (15.8%), and

tomato (2.1%). The distribution of economic value generated by vegetable farming showed that most benefits accrued directly to producers.

Table 6. Distribution of Economic Value Generated by Vegetable Farming

Component	Share (%)	Estimated Value (Ar)
Net profit of producers	62	668,174,275
Agricultural inputs and seeds	17	183,209,075
Labor	21	226,317,093
Total	100	1,077,700,444

Additional economic gains were generated through transportation and intermediary activities. The magnitude of these gains varied according to market destination.

Table 7. Estimated Added Value Generated by Transportation and Intermediaries

Destination	Initial Value (Ar)	Transport Gain (%)	Transport Gain (Ar)	Intermediary Gain (%)	Intermediary Gain (Ar)
Ambohimahavelona	129,324,053	4.5	5,819,582	3.0	3,879,722
Toliara	862,160,355	17.0	146,567,260	13.5	116,391,648

The results indicate that vegetable farming generated economic benefits not only for producers but also for transporters, traders, and intermediaries involved in the value chain.

Contribution of Vegetable Farming to Community-Based Resource Management

Survey results indicated that most local residents perceived vegetable farming as having a positive effect on reducing pressure on natural resources and biodiversity.

Table 8. Perceptions of Local Residents Regarding the Effects of Vegetable Farming on Biodiversity Pressure

Perception	Percentage (%)
Very significant positive effect	62
Moderate positive effect	24
Weak positive effect	06
No opinion	08
Total	100

Overall, 86% of respondents perceived vegetable farming as having either a very significant or moderate positive effect on reducing pressure on natural resources. Members of the Soamanampy VOI and local leaders reported even stronger positive perceptions regarding the role of vegetable farming in conservation activities

Table 9. Perceptions of VOI Members Regarding the Contribution of Vegetable Farming to Conservation

Perception	Percentage (%)
Very significant positive effect	84
Moderate positive effect	12
Weak positive effect	04
Total	100

Interview results further indicated that vegetable farming was associated with reduced dependence on charcoal production, forest clearing, and wood harvesting among some households. Respondents also reported that support received through the Soamanampy VOI, including agricultural inputs, equipment, training, and technical assistance, encouraged participation in community conservation activities such as patrols,

nursery management, reforestation, environmental awareness campaigns, fire control, and participatory ecological monitoring.

The results additionally showed that the Soamanampy VOI was recognized as one of the most active community organizations within the Amoron'i Onilahy Protected Area. The organization managed a community nursery, participated in ecological monitoring activities, and carried out approximately 13 ha of reforestation annually. More than 75% of members reported being familiar with and participating in ecological monitoring activities. Respondents also identified several constraints affecting the sustainability of vegetable farming, including dependence on water from the Onilahy River, seasonal flooding, limited production equipment, technical constraints, input availability, and challenges related to value-chain organization.

Discussion

The findings of this study demonstrate that vegetable farming has become an important livelihood activity within the community-based resource management system implemented by the Soamanampy VOI in Maroamalo. Beyond its agricultural function, vegetable farming contributes to household income generation, employment creation, food security, and local economic integration. These results support the argument that conservation initiatives are more likely to succeed when they are accompanied by economically viable livelihood opportunities for local communities (Isoto et al., 2025). In many rural contexts, environmental degradation is closely linked to poverty and limited access to alternative income sources. Consequently, livelihood diversification through income-generating activities can create incentives for communities to participate in conservation while improving their socioeconomic well-being (Schurman et al., 2025).

The production results reveal that vegetable farming is practiced throughout most of the year and generates substantial production volumes despite the semi-arid conditions that characterize southwestern Madagascar. The predominance of eggplant and pepper production reflects both local agroecological suitability and market demand. The ability of producers to maintain production across multiple seasons suggests a degree of adaptation to local environmental constraints, particularly through the utilization of water resources from the Onilahy River. Similar observations have been reported by Andriamparany et al. (2021), who found that agricultural diversification plays a crucial role in enhancing rural resilience in the dry regions of southern Madagascar, where rainfall variability and water scarcity frequently limit agricultural productivity. The continuity of vegetable production in Maroamalo therefore represents an important strategy for reducing vulnerability and strengthening household livelihood security.

The marketing structure identified in this study demonstrates the strong integration of Maroamalo into regional commercial networks. The fact that 80% of production is directed toward Toliara indicates that vegetable farming is no longer solely a subsistence activity but has evolved into a market-oriented production system. This integration into urban markets creates opportunities for income generation while linking rural producers to broader economic processes. Such findings are consistent with rural development theories that emphasize market access as a critical determinant of agricultural profitability and livelihood improvement (Goodman et al., 2003; Eric et al., 2025a). Access to larger urban markets often enables producers to benefit from higher demand and better prices, thereby increasing the economic returns from agricultural activities (Office National pour l'Environnement, 2025). However, the results also show that a substantial proportion of value is captured by transporters and intermediaries, highlighting the importance of value-chain organization and market governance in determining the final distribution of economic benefits.

The economic analysis further confirms the importance of vegetable farming as a source of rural income. The estimated annual value of production exceeds one billion Ariary, indicating a significant economic contribution at the local level (Loi n° 96-025). Particularly

noteworthy is the finding that the low-production period generated nearly half of the annual economic value despite representing a much smaller proportion of total output. This illustrates the influence of seasonal market dynamics on agricultural profitability (Schurman et al., 2025). Agricultural income is not determined solely by production volume but also by fluctuations in market prices and product availability. Similar conclusions have been reached in studies of smallholder agriculture in developing countries, where seasonal scarcity often increases commodity prices and creates opportunities for producers who can maintain production during periods of limited supply (Rasolofoson et al., 2015). The higher economic performance of pepper compared with eggplant, despite lower production volumes, further illustrates the importance of market value rather than physical output alone.

The distribution of economic value generated by vegetable farming demonstrates that a substantial share of benefits remains with producers. More than half of the estimated value corresponds to net producer income, indicating that the activity contributes directly to household welfare. This finding supports the first hypothesis of the study, which assumed that vegetable farming improves socioeconomic conditions through income generation. The importance of family labor observed in the production system is also consistent with characteristics commonly reported in smallholder farming systems across Sub-Saharan Africa, where household labor remains the primary productive resource (Mdoda & Christian, 2021). By mobilizing family labor and generating income within the household economy, vegetable farming contributes to livelihood diversification while reducing dependence on uncertain or environmentally destructive income sources.

The strong participation of women in vegetable production and marketing represents another significant outcome of this study. Women accounted for the majority of producers and traders involved in the vegetable farming value chain. This finding is particularly important because women's participation in income-generating activities is frequently associated with improved household welfare, food security, and children's well-being. Previous studies have demonstrated that increasing women's access to productive activities can strengthen household resilience and contribute to more equitable rural development outcomes (Giller et al., 2021). The prominent role played by women in Maroamalo suggests that vegetable farming may contribute not only to economic development but also to social inclusion and gender empowerment within the community.

The study also demonstrates that vegetable farming generates economic benefits beyond farming households. Transporters, traders, and intermediaries capture additional value through the commercialization process, illustrating the broader multiplier effects of the activity on the local economy (Isoto et al., 2025; Emynorane et al., 2025). Agricultural value chains often create indirect employment opportunities and stimulate economic exchanges between rural and urban areas. In the case of Maroamalo, vegetable farming supports multiple categories of actors and contributes to the circulation of income throughout the local and regional economy. Such outcomes reinforce the view that agricultural development can serve as an engine of rural economic growth when supported by effective market linkages and institutional arrangements.

One of the most important findings concerns the perceived contribution of vegetable farming to conservation and community-based resource management. The majority of respondents considered vegetable farming to have a positive effect on reducing pressure on natural resources. Local residents, VOI members, and community leaders consistently associated the activity with a decline in dependence on charcoal production, forest clearing, and wood harvesting. These perceptions align with the broader conservation literature, which argues that alternative livelihood strategies can reduce incentives for environmentally destructive practices. Gardner et al. (2016) demonstrated that charcoal production in southwestern Madagascar is strongly linked to poverty and limited livelihood alternatives. Consequently, the development of economically attractive activities such as vegetable farming may reduce the relative attractiveness of resource extraction as a source of income.

Nevertheless, the relationship between income-generating activities and conservation should be interpreted cautiously. The results do not suggest that vegetable farming automatically eliminates environmental pressures. Rather, the activity appears to reduce certain incentives that drive unsustainable resource use. This distinction is important because conservation outcomes depend on a combination of economic, institutional, and social factors. Rasolofoson et al. (2015) found that the effectiveness of community-based forest management in Madagascar varies according to local governance quality, community engagement, and socioeconomic conditions. Similarly, Gardner et al. (2018) emphasized that conservation success requires both effective institutions and tangible benefits for local populations. The findings from Maroamalo therefore support the view that livelihood improvement can strengthen conservation efforts when integrated within a broader governance framework.

The role of the Soamanampy VOI appears particularly significant in this regard. The organization serves not only as a management institution but also as a facilitator of local development through the provision of technical support, agricultural inputs, training, and organizational assistance. The strong participation of VOI members in conservation activities such as reforestation, ecological monitoring, fire management, and community patrols suggests that economic incentives and conservation objectives can reinforce one another. These findings are consistent with Ostrom's (1990) theory that successful management of common resources depends on local institutions capable of generating collective action and maintaining community engagement. The visibility and legitimacy of the Soamanampy VOI may therefore represent an important factor explaining the observed relationship between vegetable farming and conservation outcomes.

Despite these positive outcomes, the study also identifies several challenges that may affect the long-term sustainability of vegetable farming. The dependence on water from the Onilahy River represents both an opportunity and a vulnerability. While access to water enables year-round production, seasonal flooding and climatic variability can significantly disrupt agricultural activities. This situation reflects broader concerns regarding climate vulnerability in southern Madagascar, where agricultural systems are increasingly exposed to extreme weather events and environmental uncertainty. Improving irrigation infrastructure, water management practices, and flood mitigation measures may therefore be essential for maintaining the economic benefits generated by vegetable farming (Elaniriko, 2023).

Finally, the findings suggest that vegetable farming represents an effective mechanism for linking rural economic development with community-based resource management. The activity contributes to income generation, employment, food security, and market integration while supporting local conservation efforts through the provision of alternative livelihood opportunities. Although challenges remain, particularly regarding water management and value-chain organization, the experience of Maroamalo demonstrates how agricultural income-generating activities can strengthen both socioeconomic resilience and community participation in natural resource conservation. These results provide empirical support for integrated approaches that seek to reconcile rural development objectives with environmental sustainability in community-managed landscapes.

Conclusion

This study examined the socioeconomic impacts of vegetable farming under community-based resource management in Maroamalo, Southwestern Madagascar. The findings demonstrate that vegetable farming constitutes a major source of income, employment, and food security for local households. The activity generates substantial economic value, supports multiple actors along the value chain, and strengthens market linkages between Maroamalo and urban centers, particularly Toliara. Furthermore, vegetable

farming is perceived by local communities as a viable alternative to environmentally destructive activities such as charcoal production, forest clearing, and wood harvesting, thereby contributing to the objectives of community-based conservation promoted by the Soamanampy VOI. To enhance these benefits, efforts should focus on improving irrigation systems, flood management, access to agricultural inputs, technical training, and value-chain organization. Strengthening producer associations and facilitating direct market access could also increase producers' incomes by reducing dependence on intermediaries. Continued support for community-based conservation initiatives remains essential to sustain the positive relationship between livelihood improvement and natural resource management. Future research should investigate the long-term economic sustainability of vegetable farming, assess its direct effects on reducing environmental pressures, and analyze the impacts of climate variability on production systems. Comparative studies across different VOIs and community-managed landscapes would further improve understanding of the role of income-generating activities in supporting rural development and conservation objectives..

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