COMMUNITY EMPOWERMENT THROUGH WASTE COOKING OIL UTILIZATION AND DIGITAL TOURISM PLATFORM DEVELOPMENT FOR SUSTAINABLE ECONOMIC GROWTH IN PULAU PRAMUKA, THOUSAND ISLANDS, INDONESIA

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ABSTRACT

Waste cooking oil (WCO) has become one of the major environmental concerns in tourism-based communities due to its improper disposal and repeated use in households. At the same time, many small island communities face challenges in developing sustainable economic opportunities and promoting local tourism products. This study reported a community empowerment program conducted at Rumah Literasi Hijau (RLH), Pulau Pramuka, Thousand Islands, Indonesia. The program aimed to transform waste cooking oil into value-added products, including aromatherapy candles and soap, while developing a digital tourism platform to support local economic activities. A participatory action research approach was employed through training, mentoring, product development, and digital platform implementation. The results demonstrated increased community capacity in environmental management, entrepreneurship, and digital literacy. Participants successfully produced marketable products from waste cooking oil and used a web-based tourism platform to promote accommodations, tourist attractions, local products, and community activities. The integration of circular economy principles and digital transformation contributed to environmental sustainability, economic empowerment, and tourism development. The findings suggest that combining waste recycling initiatives with digital innovation can serve as an effective model for sustainable community development in island tourism destinations.

Keywords: *circular economy; community empowerment; digital transformation; sustainable tourism; waste cooking oil*

INTRODUCTION

Environmental sustainability and community economic empowerment have become increasingly important concerns in tourism destinations worldwide. Although tourism provides

opportunities for employment, entrepreneurship, and local economic development, it can also generate environmental pressures through waste production, resource consumption, and increased demand for infrastructure and public services. These challenges are particularly relevant in coastal and island destinations, where the quality of natural resources is closely connected to tourism attractiveness and community livelihoods. Consequently, sustainable tourism development requires integrated approaches that address environmental conservation while strengthening the economic capacity and participation of local communities.

One environmental issue associated with household activities and tourism-related businesses is the improper management of waste cooking oil (WCO). Waste cooking oil is generated through food preparation activities in households, restaurants, catering services, food stalls, and other businesses. Repeated heating and frying can cause oxidation, hydrolysis, and other chemical changes that affect oil quality. When discarded improperly, WCO can contribute to drainage blockages, wastewater contamination, and environmental pollution. When untreated grease and oil enter aquatic environments, they form surface films that block oxygen exchange, disrupt marine biodiversity, and clog municipal drainage infrastructure. Repeated use of degraded cooking oil may also raise food safety concerns. These issues highlight the importance of promoting responsible oil management, appropriate collection practices, and alternative applications for used cooking oil.

Rather than treating WCO solely as waste, communities can explore opportunities to recover its value through appropriate processing. Previous studies have discussed the potential of converting used cooking oil into products such as soap and other materials, thereby supporting waste reduction and community entrepreneurship (Alias et al., 2023; Mahmudah & Shofiah, 2023). Aromatherapy candles have also been considered as potential value-added products, including souvenirs that can be associated with local tourism experiences (Cornellia & Istiraharsi, 2026; Shofiah et al., 2025). These initiatives reflect the principles of the circular economy, which emphasize resource efficiency, waste reduction, and the recovery of value from materials that might otherwise be discarded. Converting

spent oil into value-added items transforms a potential environmental pollutant into a functional economic asset, exemplifying the restorative principles of a closed-loop system. However, successful implementation requires suitable processing techniques, product quality control, entrepreneurial skills, and access to potential markets. Scaling such initiatives from pilot workshops to viable commercial operations also requires consistent raw material supply, standardized product quality, and safety benchmarks such as burn efficiency and low smoke emission in candles, as well as transparent branding that avoids greenwashing.

Pulau Pramuka, located in the Thousand Islands Regency of Jakarta, Indonesia, provides a relevant setting for integrating environmental management with community-based economic development. The island has tourism potential associated with marine attractions, coastal environments, local culture, and community-based tourism activities. These resources create opportunities for local enterprises offering accommodation, food, souvenirs, and other tourism-related services. At the same time, maintaining the environmental quality of an island destination requires responsible waste management and active community participation. Modern travelers increasingly seek authentic, eco-conscious experiences, so upcycled souvenirs can serve as tangible representations of a community's ecological initiatives and turn a simple purchase into a meaningful engagement with local culture.

Local businesses and community organizations may face challenges in developing marketable products, expanding customer access, and promoting tourism services through digital channels. Small enterprises can possess valuable local knowledge and practical production skills but may have limited resources for branding, digital marketing, product presentation, and customer communication. These constraints can reduce their ability to benefit from tourism-related demand. Tourism economies in island regions are also frequently vulnerable to seasonal fluctuations and external shocks, so small-scale manufacturing initiatives based on recycled goods can create supplementary income streams for

community members, particularly women and youth, thereby strengthening household financial resilience.

Community empowerment offers a foundation for addressing these interconnected challenges. Empowerment initiatives strengthen the knowledge, skills, confidence, and participation of individuals and groups in activities that influence their livelihoods. Through training, mentoring, and collaborative implementation, community members can develop practical competencies, identify local resources, and participate in entrepreneurial activities. Previous studies have emphasized the importance of community participation in sustaining development initiatives and strengthening local ownership (Akbar et al., 2021; Wani et al., 2024). Empowerment programs that involve local communities in planning, implementation, and evaluation tend to achieve better outcomes and increase local support for sustainable tourism development.

Digital transformation provides an additional opportunity to support these objectives. Digital platforms can improve access to destination information, facilitate the promotion of tourism services, and provide communication channels for local products (Astuti et al., 2024). Recent studies indicate that digital platforms contribute significantly to tourism competitiveness, particularly in rural and island destinations where market access is limited (Egodawele et al., 2022; Megawati et al., 2025). In small island and remote destinations, geographical isolation often creates barriers to market visibility and economic inclusion, and digital tools bridge this divide by establishing direct communication links between local providers and prospective travelers. Cloud-based inventory platforms and mobile payment solutions further enable micro, small, and medium enterprises (MSMEs) to streamline transactions and manage capacity. Nevertheless, digital infrastructure alone does not guarantee economic benefits. Its contribution depends on the quality of information, usability, stakeholder participation, digital literacy, and the continuity of content management, and digital literacy gaps and limited telecommunications infrastructure can hinder adoption.

Although waste recycling, community empowerment, and digital tourism promotion are individually relevant to sustainable development, their integration offers an opportunity to connect environmental practices with product development and market access. Waste management initiatives can generate greater community value when recovered materials are transformed into products with potential commercial applications. Digital promotion can complement this process by providing a channel through which those products and other tourism services can be introduced to prospective consumers. This integrated approach creates a practical connection between environmental responsibility, entrepreneurship, and tourism development.

To address these issues, a community service program was implemented in collaboration with Rumah Literasi Hijau (RLH) on Pulau Pramuka. The program combined two principal interventions: the utilization of waste cooking oil to produce soap and aromatherapy candles, and the development of a digital tourism information platform to promote local tourism services and products. The recycling activities introduced participants to waste preparation and product development, while the digital platform provided functions for tourism information, accommodation reservations, product browsing, and administrative content management.

This study describes the implementation of the integrated program and examines its potential contribution to environmental awareness, value-added product development, community empowerment, and digital tourism promotion. Specifically, it aims to: (1) describe the utilization of WCO as a resource for developing soap and aromatherapy candles; (2) explain the development of a digital tourism platform for presenting local tourism services and products; and (3) discuss how the combination of environmental activities, entrepreneurial learning, and digital technology can support community-based sustainable tourism. The program contributes a practical example of integrating circular economy practices and digital tourism infrastructure within a community service initiative in an island destination.



Figure 1. Community training session on waste cooking oil utilization at Rumah Literasi Hijau, Pulau Pramuka

IMPLEMENTATION AND METHODS

The community empowerment program was carried out at Rumah Literasi Hijau (RLH), Pulau Pramuka, Thousand Islands Regency, Indonesia, from January 2026 to June 2026. A total of 30 participants, comprising local youth, community members, and RLH management staff, were recruited using purposive sampling. Recruitment was coordinated through open community invitations and direct engagement with RLH leaders and local neighbourhood heads (RT/RW).

This study employed a Participatory Action Research (PAR) approach, which emphasizes ongoing cooperation between researchers, community members, and local stakeholders (Balakrishnan et al., 2023; Fine, 2024). The initiative was carried out through iterative PAR cycles, each consisting of four interconnected phases (Abma & Cook, 2025; Chevalier & Buckles, 2023): Plan, in which stakeholders worked together to identify local needs and create customized action plans; Act, in which the agreed plans were carried out with shared responsibility; Observe, in which the implementation process and its early effects were systematically tracked and recorded; and Reflect, in which all participants assessed results in order to identify lessons learned and improve strategies for subsequent cycles. This cyclical process fostered genuine co-ownership of the programme and built local capacity, allowing interventions to be adapted dynamically to emerging challenges.

Following the collaborative planning phase, the intervention incorporated structured mentoring to support practical execution. Mentoring consisted of bi-weekly hands-on coaching, technical workshops, and continuous field facilitation covering eco-literacy, community engagement, and environmental management. Research facilitators worked directly with participants to troubleshoot challenges and reinforce capacity building throughout each cycle. The programme was delivered in four stages. First, a needs assessment used initial observations and discussions to identify community needs related to environmental management, economic development, and tourism promotion. Second, training and capacity building covered waste cooking oil collection and purification, soap production techniques, aromatherapy candle production, packaging and branding strategies, and entrepreneurial skills development. Third, a web-based tourism platform was developed with user registration and authentication, tourism information management, accommodation booking, local product promotion, and community news dissemination. Fourth, monitoring and evaluation assessed participant involvement, product outputs, website implementation, and community feedback.

Data were collected using semi-structured interviews, focus group discussions (FGDs), participatory field observations, and pre- and post-activity questionnaires. Qualitative data were analysed through thematic analysis (Braun & Clarke, 2021) to identify emerging patterns and participant perspectives, while quantitative data were evaluated using descriptive statistics to track changes in community capacity and engagement. Progress was monitored at the conclusion of each PAR phase using collaborative evaluation rubrics and reflection logs, allowing stakeholders to collectively assess outcomes, draw lessons learned, and refine strategies for subsequent cycles.

RESULTS AND DISCUSSION

Waste Cooking Oil Recycling Activities

The program successfully introduced waste cooking oil processing techniques to community members. Participants learned to filter, purify, and transform WCO into soap and aromatherapy candles, as illustrated in Figure 1. Several supporting materials were used during the training

activities, including fragrance oils, candle moulds, wax materials, colorants, and candle containers, enabling participants to create products with commercial value. The production process not only reduced environmental waste but also introduced a new source of income for participating households.

Development of Value-Added Products

Two primary products were developed through the program. Aromatherapy candles were produced using recycled oil, fragrance oils, colouring materials, and decorative moulds, and were designed as tourism souvenirs targeting visitors to Pulau Pramuka. Handmade soap production used waste cooking oil combined with sodium hydroxide (NaOH) and additional ingredients to create environmentally friendly household products. The resulting products demonstrated the feasibility of transforming waste materials into marketable goods through community-based entrepreneurship.

Digital Tourism Platform Implementation

A tourism information system was developed to support local economic activities and sustainable tourism development, as shown in Figure 2. For users, the platform provides registration and login, profile management, tourism information access, accommodation booking, and product browsing with purchasing support. The accommodation reservation system allows tourists to view accommodation details, select room types, and make reservations online, while booking history and transaction management functionalities further enhance user convenience. Local products are displayed through a dedicated product page where users can view product information and contact community representatives through WhatsApp for purchases. The platform also includes administrative functionalities for managing tourism attractions, accommodations, products, articles and news, and booking transactions. This integrated platform strengthens destination promotion while supporting local entrepreneurship.

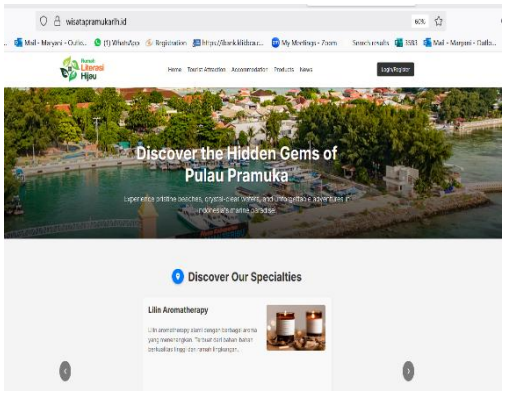


Figure 2. Homepage of the digital tourism platform developed for Pulau Pramuka

Community Empowerment Outcomes

Comparison of conditions before and after the program indicated several positive outcomes: increased awareness regarding environmental sustainability; improved skills in recycling waste materials; enhanced entrepreneurial competencies; strengthened community participation; increased digital literacy; and improved tourism promotion capabilities. Before the program, waste cooking oil was generally discarded into household drainage and participants had no experience in processing it, while promotion of local products relied on word of mouth. After the program, participants were able to produce and package marketable products independently and to manage content on the tourism platform. These outcomes align with previous findings that empowerment programs contribute significantly to sustainable community development (Akbar et al., 2021; Wani et al., 2024).

Contribution to Sustainable Tourism

The initiative supports sustainable tourism through environmental conservation and local economic development. The production of tourism souvenirs from recycled materials reflects circular economy principles and promotes environmentally responsible tourism practices (Cornellia & Istiraharsi, 2026). Moreover, the digital tourism platform facilitates information dissemination, online reservation services, and destination marketing, contributing to tourism competitiveness and visitor satisfaction (Megawati et al., 2025). The main inhibiting factors observed during implementation were uneven digital literacy among participants and the need for continuous content management,

while the strong involvement of RLH management and local neighbourhood leaders acted as the principal driving factor.

CONCLUSION

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This study shows how community empowerment programs may turn waste cooking oil into value-added goods such as soap and aromatherapy candles. The initiative at Rumah Literasi Hijau, Pulau Pramuka, improved community capacity in waste management, product development, and entrepreneurship. The deployment of a digital tourism platform additionally supported local product marketing, lodging booking services, and destination promotion. The convergence of circular economy practices with digital transformation therefore presents opportunities to improve local economic resilience, environmental sustainability, and sustainable tourism development. The methods applied, particularly the participatory action research cycles, were appropriate to the needs and challenges of the partner community, since participants were involved from needs assessment through evaluation. The main supporting factors were the commitment of RLH management and local leaders, while the main inhibiting factors were uneven digital literacy and the need for continuous platform maintenance.

Suggestion

Several limitations should be noted. The results may not be fully transferable to other tourist locations because the implementation was carried out in a particular community setting, and the long-term economic and environmental effects, such as changes in community income, user acceptance of the digital platform, business profitability, and product sales consistency, have not yet been thoroughly assessed. Future activities should therefore concentrate on increasing product commercialization through better branding, packaging, quality control, and wider market access. Digital payment methods, business intelligence dashboards for tourism analytics, and user feedback mechanisms should be integrated into the platform. Longitudinal assessments should also be carried

out to track changes in community income, business performance, environmental benefits, and user uptake over time. Strengthening collaboration with local government, tourism operators, lodging providers, and small and medium-sized businesses remains crucial to assist implementation, knowledge transfer, and long-term program viability, so that the integrated circular economy and digital tourism model becomes more scalable and replicable in other community-based tourism locations.

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