E-ISSN: 2746-9107 | P-ISSN: 3047-4248

JOURNAL OF SOCIETY INNOVATION AND DEVELOPMENT

Empowering Women, Enhancing Essential Oils: Gender-Responsive Patchouli Seedling Enterprises in Aceh, Indonesia

Suraiya Kamaruzzaman[1], Irfan Zikri[2], Ernawati Ernawati[3], Friesca Erwan[4*]

[1]Chemical Engineering Department, Engineering Faculty & Aceh Climate Change Initiative (Pusat Riset Perubahan Iklim), Universitas Syiah Kuala, Banda Aceh 23111, Indonesia; [2]Agribusiness Department, Faculty of Agriculture, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia; [3]Faculty of Economics and Business & Atsiri Research Center PUI PT Nilam Aceh, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia; [4]Industrial and Mechanical Engineering Department, Engineering Faculty, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia

*Corresponding author: Friesca Erwan, Industrial and Mechanical Engineering Department, Engineering Faculty, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia. Email: friesca_erwan@usk.ac.id

Abstract

Desa Teuladan in Aceh Besar has significant potential for patchouli (Pogostemon Cablin Benth.) production. However, the development is constrained by limited access to quality local seedlings, weak institutional structures, and low women's participation. This study aims to promote inclusive entrepreneurship through gender-responsive approaches, focusing on strengthening technical skills, establishing seedling enterprises, and fostering local economic institutions. Using Participatory Action Research (PAR) and gender mainstreaming principles, this study conducted training on seedling cultivation, organic composting, and basic business management, while facilitating the formation of women-led entrepreneurial groups and developing operational tools, including training modules, SOPs, and digital record-keeping systems. The initiative produces 1,500 high-quality seedlings with a 95% survival rate and establishes the Desa Teuladan Inclusive Patchouli Enterprise. The initiative also increases women's empowerment, improves household income, and encourages more sustainable agricultural practices. These outcomes demonstrate a replicable model of gender-inclusive entrepreneurship that contributes to local development and university-community collaboration.

Keywords: Patchouli, Inclusive Entrepreneurship, Gender Mainstreaming, Community Empowerment, Sustainable Agriculture

Introduction

The essential oil industry, including patchouli (Pogostemon cablin Benth), is a strategic agribusiness sector that makes substantial contributions to global trade. Patchouli oil remains a primary raw material for perfumes, cosmetics, and health products, sustaining a relatively stable international demand (Verma et al., 2024; Pandey et al., 2021). Despite this economic potential, the sector continues to face persistent challenges related to sustainability, productivity, and gender equity. Extractive and agribusiness industries in many countries remain male-dominated, while women frequently encounter structural barriers in accessing resources, training, and decision-making spaces (EITI, 2023; Menard & Moses, 2021). Such disparities limit women's participation across essential oil value chains, even though their involvement has been shown to strengthen household economic resilience and advance sustainable development outcomes (Uduji et al., 2023).

Received: March 19, 2026 - Accepted: May 10, 2026 - Published online: May 11, 2026

At the local level, Aceh Besar has a long history of producing patchouli since the 1990s. Desa Teuladan in Lembah Seulawah District once experienced a period of prosperity driven by patchouli cultivation. In contrast, production has since declined due to market price fluctuations, land degradation, and limited access to high-quality planting materials. Recent studies indicate that patchouli productivity in Aceh remains low and that farmer institutions have not functioned optimally (Cantika et al., 2022; ARC, 2025). Moreover, women's roles in patchouli farming are still largely confined to supporting tasks, such as weeding and raw-material collection, without adequate access to technical training or involvement in economic decision-making (ARC, 2025). This situation reinforces gender gaps in agricultural resource management and constrains inclusive rural development.

A critical gap emerging from this context is the absence of an inclusive entrepreneurship model that integrates the development of high-quality patchouli seedlings with a gender-responsive approach. Existing assistance activities tend to focus on technical aspects of cultivation and production, while socio-economic dimensions, particularly women's empowerment, receive limited attention. The novelty of this initiative lies in establishing a gender-responsive patchouli seedling enterprise that positions women as central actors in production, management, and distribution processes.

This community-engagement study aims to develop an inclusive entrepreneurial model by strengthening gender-responsive patchouli seedling production in Desa Teuladan, Aceh Besar. The study seeks to identify farmers' technical and managerial capacities, determine women's participation in productive sectors, and propose strategies to build a sustainable local enterprise. The urgency of this study extends beyond improving patchouli productivity to contributing to key Sustainable Development Goals (SDGs), particularly poverty reduction, gender equality, and institutional strengthening at the village level. Ultimately, this initiative is expected to serve as an innovative and replicable model for developing locally based agribusiness commodities in other regions.

Desa Teuladan in Aceh Besar possesses considerable potential to develop a competitive patchouli agribusiness, but this potential has not yet translated into sustainable or equitable economic gains. Field observations and situational analyses reveal several structural constraints that continue to hinder productivity, enterprise development, and gender-balanced participation within the local patchouli sector. A primary challenge is the unavailability of high-quality locally produced, sustainably grown patchouli seedlings. On the other hand, farmers continue to rely on planting materials sourced from other districts, such as Aceh Selatan and Aceh Tamiang, without clear information regarding varietal identity or genetic quality. This practice heightens the risk of disease transmission, reduces plant vigor, and contributes to inconsistent yields, rendering local cultivation efforts unable to guarantee stable production in either quantity or quality. (Thomas-Sharma et al., 2017; Fuchs et al., 2020; Mouafo-Tchinda et al., 2024). Figure 1 illustrates five underlying factors that hinder the development of a gender-responsive patchouli seedling enterprise in Aceh Besar, underscoring the need for a comprehensive, context-sensitive intervention grounded in Participatory Action Research (PAR).

Figure 1. Problems-solution framework of gender-responsive patchouli seedling enterprise development in Aceh Besar

Technical limitations further exacerbate these issues. The majority of farmers lack adequate knowledge and skills in seedling propagation, including selecting healthy mother plants, using proper stem-cutting techniques, using sterile growing media, and managing pests. Low propagation success rates indicate that current practices remain largely dependent on traditional experience rather than standardized modern techniques. This gap in technical capacity undermines the efficiency and reliability of seedling production.

Gender disparities also persist within the village's patchouli value chain. Women's involvement is generally restricted to labor-intensive supporting tasks, while access to training, capital, and managerial roles remains limited. These constraints reflect entrenched gender norms that marginalize women from productive decision-making processes and restrict their opportunities to benefit from agribusiness development. Consequently, the economic advantages of patchouli cultivation are unevenly distributed across households.

Institutional weaknesses present an additional barrier. Existing farmer groups operate informally, without clear organizational structures, standard operating procedures, financial records, or mechanisms for collective responsibility. The absence of a structured and gender-responsive enterprise model prevents these groups from evolving into resilient economic units capable of sustaining long-term seedling production.

Finally, limited market access and weak distribution networks constrain the commercialization of patchouli seedlings. Despite increasing regional demand, farmers lack stable market linkages, digital promotion strategies, and partnerships with buyers or supporting institutions. As a result, economic opportunities remain localized and sporadic, preventing the community from capturing the full value of the seedling market.

Methods

This study employed a Participatory Action Research (PAR) design to guide the development of a gender-responsive patchouli seedling enterprise in Desa Teuladan, Aceh Besar. PAR was selected since it enables collaborative knowledge production, positions community members as co-researchers, and emphasizes iterative cycles of reflection, action, and evaluation. The research design integrates gender mainstreaming, capacity building, technological empowerment, and multi-stakeholder collaboration to ensure that both the technical and socio-economic dimensions of the intervention are comprehensively addressed.

Data Sources

Data for this study was obtained from a combination of primary and secondary sources to comprehensively capture the technical, social, and institutional dimensions of the intervention. Primary data were generated through Focus Group Discussions (FGDs) with farmer groups and women entrepreneurs, in-depth interviews with village leaders, ARC technical staff, and group members, and systematic field observations conducted during training sessions, seedling production activities, and mentoring processes. Additional primary data were collected from production records maintained at the demonstration nursery and participation logs documenting the extent and nature of women's involvement throughout the program. These sources provided rich, context-specific insights into community practices, gender dynamics, and the intervention's effectiveness. Secondary data were gathered from village development documents, technical manuals produced by the Atsiri Research Center (ARC) on patchouli cultivation, and relevant scholarly literature on gender, agribusiness development, and community empowerment. Together, these data sources enabled a robust triangulation process and supported a holistic understanding of the program's outcomes and implications.

Data Collection

Data collection employs multiple qualitative and quantitative methods to ensure a comprehensive understanding of the program's technical, social, and institutional dynamics. Focus Group Discussions (FGDs) were conducted during the preparatory stage to map community needs, identify gender roles, and validate existing challenges in patchouli cultivation. Each FGD involved 10-15 participants representing farmers, women's groups, and village authorities, allowing for diverse perspectives to emerge. Semi-structured interviews with key informants, including village leaders, ARC technical staff, and group members, provided deeper insights into institutional constraints, gender norms, and expectations for the seedling enterprise. Systematic field observations were undertaken throughout the training sessions, seedling propagation activities, compost production, and daily maintenance routines, focusing on technical performance, group coordination, and women's participation. Documentation review of program materials, training modules, and village records supported triangulation and contextual interpretation of findings.

In addition, production data were recorded using a simple monitoring instrument designed to track seedling survival rates, growth performance, and production volume across three propagation cycles totaling 1,500 polybags.

To support these data-collection processes, several instruments were employed. FGD and interview guides were used to explore community needs, gender roles, and institutional dynamics in a structured yet flexible manner. Observation sheets facilitated systematic documentation of training participation, technical practices, and group interactions. A seedling production logbook was maintained to record daily maintenance activities, watering schedules, pest-management practices, and survival rates. A gender participation checklist was used to monitor women's involvement in decision-making, technical tasks, and managerial responsibilities. Finally, training evaluation forms were administered to assess improvements in participants' knowledge and skills. Together, these methods and instruments provided a robust empirical foundation for analyzing the program's outcomes and assessing its broader implications for gender-responsive agribusiness development.

Data Analysis Techniques

Data was analyzed using a combination of qualitative and descriptive quantitative techniques to capture the multidimensional outcomes of the intervention. Thematic analysis was applied to FGD transcripts, interview notes, and observation records to identify recurring patterns related to gender roles, institutional challenges, community learning processes, and the adoption of new technologies. Descriptive statistics, including percentages, frequencies, and averages, were used to examine seedling production data, survival rates, and participation metrics, providing a clear picture of technical performance and group engagement. To ensure the validity and reliability of findings, triangulation was conducted by comparing insights derived from interviews, observations, production records, and program documentation. Reflective analysis was also integrated into each cycle of the Participatory Action Research (PAR) process, allowing the research team and community members to jointly interpret emerging results, refine ongoing interventions, and adapt strategies based on contextual feedback and evolving needs. Together, these analytical techniques provided a robust foundation for understanding the program's impacts and informing future community-based agribusiness initiatives.

Findings

Prior to the implementation of the community engagement study in Desa Teulada, the village exhibited the characteristics of a traditional agricultural community with substantial agribusiness potential but limited capacity to develop it effectively. The baseline assessment revealed several structural constraints that shaped the intervention's design and underscored the need for a gender-responsive, capacity-building approach. After more than one month of implementation, notable improvements were observed in community capacity, group organization, and technical outcomes. After four months of implementation, notable improvements were observed in community capacity, group organization, and technical outcomes. Table 1 shows the results of implementing PAR in this study.

Table 1. Key activities of improvement using Participatory Action Research (PAR)

Aspect	Before implementing PAR	After implementing PAR
Technical capacity	-No quality seedling -Limited propagation skill	-1,500 high-quality seedling -95% survival rate -SOPs implemented
Social participation	Women excluded from decision-making	-Women hold 70% of leadership roles -Active involvement in technical tasks
Intuitional Strength	-Informal farmer groups -No structure or records	-Formal enterprise group established -Clear roles, SOPs, and documentation

Economic potential	-no seedling enterprise -no income opportunities	Seedling production initiated early market outreach underway
Academic output	No documentation or dissemination	Draft article, documentary video, and media publications produce.

Discussion

The findings of this study contribute to the broader discourse on community empowerment, gender-responsive development, and rural agribusiness transformation. Prior research has emphasized that strengthening local capacities and institutional arrangements is essential for improving agricultural productivity and sustaining rural livelihoods. This study extends that discussion by examining how a participatory, gender-inclusive intervention can enhance technical skills, organizational structures, and entrepreneurial readiness within a patchouli-producing community. In doing so, it directly addresses the research question concerning how community-based approaches can foster inclusive agribusiness development and strengthen local economic resilience.

Restating the key results, the program achieved a notable improvement in seedling survival rates and successfully produced 1,500 high-quality seedlings. This outcome underscores the effectiveness of the PAR-based training model, which enabled farmers to internalize cultivation techniques through iterative, hands-on learning. These findings reinforce earlier work by Prajapati et al. (2025), Pawera et al. (2024), and Ensor and De Bruin (2022), who argue that participatory methods enhance local ownership and accelerate the adoption of agricultural innovations. Interestingly, the magnitude of improvement observed in this study was higher than initially anticipated, suggesting that communities with limited prior exposure to structured training may respond particularly well to experiential learning approaches.

A particularly important and somewhat unexpected finding is the substantial increase in women's leadership and technical involvement. While previous studies (Zikri et al., 2021; Lecoutere & Chu, 2023; Arintyas, 2024) have shown that women's empowerment contributes to household welfare and value-chain resilience, the rapid shift in gender dynamics observed here indicates that women may assume leadership roles more readily when institutional support and safe learning spaces are intentionally created. This challenges assumptions that cultural norms alone are the primary barrier to women's participation; instead, it suggests that structural opportunities and facilitative environments can catalyze meaningful change.

The establishment of a formal enterprise group, complete with SOPs, defined roles, and digital record-keeping systems, represents a significant institutional advancement. Stronger organizational structures are widely recognized as prerequisites for sustaining rural enterprises, improving market access, and building long-term partnerships (Scott, 2023; Suresh & Ss, 2024). The results of this study support these claims, demonstrating that institutional strengthening can emerge even in early-stage community programs when governance and management components are integrated into technical training. However, the pace of institutional consolidation may vary across contexts, and caution is warranted in generalizing these outcomes without considering local leadership dynamics and resource availability.

The emergence of early economic potential particularly through seedling sales and the development of a patchouli-based dishwashing soap prototype illustrates the community's growing capacity for innovation and value addition. This aligns with broader literature on micro-enterprise diversification as a pathway to rural economic resilience (Kamaruzzaman et al., 2024; Silvia et al., 2023; Erwan et al., 2023). Yet, the limited scale of current production suggests that economic gains remain preliminary. Future market performance will depend on factors such as product quality consistency, access to distribution channels, and the community's ability to maintain organizational cohesion.

Taken together, these findings suggest a general hypothesis: gender-responsive participatory approaches may accelerate both technical learning and institutional strengthening, thereby enhancing the readiness of rural communities to engage in value-added agribusiness activities. This hypothesis warrants further testing across different commodities and socio-cultural settings.

Despite the promising outcomes, several limitations must be acknowledged. The program's short implementation period restricts the ability to assess long-term sustainability, and the economic impacts observed thus far are still emerging. Additionally, the study relied on qualitative observations and program monitoring data, which may not fully capture variations in household-level benefits. These limitations call for cautious interpretation of the findings and highlight the need for longitudinal studies to evaluate the durability of institutional and gender-related changes.

Implication

The implications of this study are multifaceted. The findings demonstrate that integrating technological innovation, social empowerment, and gender-responsive approaches can generate meaningful and multidimensional change at the community level. Women's participation evolved from peripheral involvement to central leadership, particularly in managing the nursery and maintaining production records. This shift indicates a transformation not only in skills but also in confidence and social recognition.

The collaboration between lecturers, students, and community partners also illustrates the effectiveness of a university–community partnership model. The program fostered mutual learning, strengthened local capacity, and created a foundation for sustainable enterprise development. Furthermore, the initiative aligns with several Sustainable Development Goals (SDGs), including poverty reduction, gender equality, quality education, and strong institutions.

While the study achieved substantial progress, several areas require further attention. Market linkages need to be strengthened to ensure the long-term viability of the seedling enterprise. Continued mentoring is also necessary to support financial management, product diversification, and digital marketing. Future initiatives may explore scaling the model to neighboring villages or integrating more advanced technologies for cultivation and processing.

Conclusion

The gender-responsive study based on patchouli seedling cultivation in Desa Teuladan, Lembah Seulawah, Aceh Besar, demonstrates that a Participatory Action Research (PAR) approach, when integrated with principles of gender-inclusive entrepreneurship, can produce a sustainable, contextually grounded model of community empowerment. By combining technological innovation with social, economic, and environmental considerations, the program not only strengthened farmers' technical competencies in high-quality patchouli seedling production but also elevated women's role as central actors in the agricultural value chain.

The activities' outcomes are evident in the successful production of high-quality seedlings with a high survival rate, the establishment of a gender-responsive enterprise group, and the emergence of relevant technological and product innovations. These achievements translated into tangible social and economic benefits, including increased group income potential, stronger social networks, and heightened awareness of sustainable agricultural practices. The initiative also reinforced academic engagement through the active involvement of lecturers and students, resulting in training modules, scientific publications, and other academic outputs that enhance Universitas Syiah Kuala's reputation as a leader in social innovation in Aceh.

A key contribution of this study lies in the development of a gender-inclusive entrepreneurship model that can serve as a best practice for replication in other regions. The model underscores that rural economic empowerment requires more than technical interventions; it depends on strengthening social and institutional capacities that position women as decision-makers and leaders. In doing so, the program aligns closely with the Sustainable Development Goals (SDGs), particularly those related to poverty reduction, gender equality, and resilient local economic development.

Overall, this study provides a meaningful contribution to community economic strengthening, the advancement of applied knowledge, and the creation of an inclusive empowerment model. Its relevance and sustainability position it as a flagship form of community engagement capable of bridging academic, governmental, and community interests in building productive, self-reliant, and socially just rural communities.

Ethics approval

Not required.

Acknowledgments

The authors extend their sincere appreciation to the Research and Community Service Institute (LPPM) of Universitas Syiah Kuala (USK) for providing financial support for this program through the 2025 Village-Assisted Community Service (PKM-BPB) scheme. This support enabled the successful implementation of the activities in Desa Teuladan and contributed significantly to the program's academic and community impacts.

Competing interests

The authors declared no potential conflicts of interest with respect to the activities, authorship, and/or publication of this article.

Underlying data

Derived data supporting the findings of this study are available from the corresponding author on request.

Declaration of artificial intelligence use

During the preparation of this manuscript, the authors used Copilot and Grammarly to assist with language editing and readability only when necessary. The tool was not used to generate scientific content or analysis. We confirm that all AI-assisted processes were critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were solely made by the authors.

How to cite

Kamaruzzaman, S., Zikri, I., Ernawati, E., & Erwan, F. (2026). Empowering Women, Enhancing Essential Oils: Gender-Responsive Patchouli Seedling Enterprises in Aceh, Indonesia. *Journal of Society Innovation and Development*, *7*(2), 319–326. https://doi.org/10.63924/jsid.v7i2.279

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