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Empowering Women Farmers Through Technology: Potato Chip Production Enhancement in Sedaeng Village

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ABSTRACT

Sedaeng Village in Pasuruan Regency, East Java, is characterized by fertile agricultural land and a strong culture of community participation. Among its local initiatives, the Dewi Sri Rejeki Women Farmers Group (Kelompok Wanita Tani – KWT), comprising 14 members, has long produced potato chips using traditional methods. However, the absence of standardized processing technology and limited managerial skills has hindered production efficiency, consistency, and marketing reach. To address these challenges, a Community Partnership Program (PKM) was implemented to empower the group through appropriate technology transfer, entrepreneurship training, and digital marketing development. The intervention introduced a semi-automatic potato slicer and an oil-spinner machine, improved packaging and labeling, and strengthened members' capacity in business management and financial recording. The program applied a participatory and educational approach, combining technical demonstrations, workshops, and mentoring sessions to ensure active involvement and skill adoption. Quantitative results indicated a substantial improvement in production performance: slicing and draining time was reduced by 65 percent, oil content declined from 25 to 10 percent, and production output increased by approximately 60 percent, from 50–60 to 90–100 packs per week. Qualitatively, members demonstrated stronger entrepreneurial motivation, better coordination, and greater confidence in expanding their market reach through digital platforms. The outcomes highlight the effectiveness of combining technology adoption, managerial empowerment, and marketing innovation in strengthening rural women's economic independence. This PKM initiative not only enhanced the productivity and competitiveness of Sedaeng's women farmers but also serves as a replicable model for sustainable community-based agroindustry development in similar rural contexts.

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INTRODUCTION

Sedaeng Village, located on the slopes of Mount Bromo within the Bromo Tengger Semeru National Park (TNBTS) in Pasuruan Regency, East Java, is home to the Tengger Bromo ethnic community. The area is known not only for its cultural tourism potential but also for its fertile agricultural land that supports the cultivation of potatoes (Solanum tuberosum L., Granola variety), corn, and various vegetables. During each harvest season, local farmers in Sedaeng produce approximately 500 kilograms to 1 ton of sorted potatoes that are suitable for processing into chips and other value-added snack products. However, the potential to convert these yields into sustainable income remains largely untapped due to limited processing technology and inadequate business management. Among the local initiatives, the Dewi Sri Rejeki Women Farmers Group (Kelompok Wanita Tani – KWT), consisting of 14 active members, has been engaged in producing potato chips as part of a community-based economic effort. Despite access to raw materials, the group's productivity remains modest, averaging only 50–60 packs per week. This limitation is mainly attributed to traditional manual processing methods such as hand-slicing and stove-based drying, which result in lengthy processing times, inconsistent quality, high oil content, and limited marketing outreach.

Several factors constrain the group's capacity for growth. Technological limitations hinder efficiency and consistency, while weak managerial and organizational practices impede effective planning and record-keeping. Market access remains restricted because of the absence of modern packaging, branding, and digital promotion. Socio-cultural barriers, including limited exposure to entrepreneurship and gendered labor divisions, further reduce women's participation in value-added agricultural production. These challenges reflect the broader pattern of underdeveloped micro, small, and medium enterprises (MSMEs) in Indonesia's rural areas, particularly those led by women in the agro-processing sector.

The concept of community empowerment emphasizes building individuals' and groups' capacity to manage resources independently, competitively, and sustainably (Chambers, 1995). Empowerment is achieved not only through resource provision but also through capability enhancement, participatory learning, and access to markets. The application of appropriate technology—defined as simple, affordable, and locally adaptable innovation—has proven effective in increasing productivity, reducing production costs, and improving quality control for rural agro-industries (Slamet, 2018). Furthermore, digital transformation in rural enterprises offers new opportunities for visibility and growth. According to Kotler and Keller (2016), and Strauss and Frost (2014), digital marketing platforms provide cost-effective tools for expanding customer reach and strengthening product branding, particularly for small producers.

Previous studies support the integrated use of technology, management, and digital literacy for empowering farming communities. For instance, research in East Java showed that technical efficiency in potato cultivation is influenced by gender, land size, and the adoption of modern tools, underscoring the need for targeted technological interventions to improve productivity. Similarly, studies in Banyumas found that digital marketing training significantly improved farmers' access to broader markets through social media and e-commerce, although adoption depends on digital literacy and institutional support. Parallel findings were reported in a study on sweet potato chip diversification in Banjarwangi Village, where flavor innovation and packaging redesign enhanced product appeal and household income. Another relevant study in Batu City emphasized that clustering and institutional coordination among

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potato chip SMEs strengthened production standardization and supply chain efficiency.

Recent literature also underscores the importance of digital literacy and the role of extension services in promoting agricultural innovation and knowledge dissemination (AP-FFTC, 2024). A systematic review of empowerment programs in Indonesia concluded that participatory approaches, coupled with technological innovation, are consistently associated with sustainable improvements in rural livelihoods (Sustainability, 2024). Complementing these findings, Rachmawati (2021) highlights in her work on rural women's entrepreneurship that empowerment initiatives integrating business training, technology use, and marketing capacity can transform domestic laborers into independent economic actors. Such frameworks are essential for translating empowerment into measurable socio-economic outcomes.

This program was designed to strengthen the Dewi Sri Rejeki Women Farmers Group through an integrated empowerment model encompassing technology transfer, entrepreneurship training, product innovation, and digital marketing. The objectives of the program were to (1) introduce semi-automatic processing tools to improve efficiency and product consistency; (2) enhance managerial and entrepreneurial competencies through participatory training; (3) expand marketing reach through social media and digital branding; and (4) evaluate the program's quantitative and qualitative impacts as a basis for replication in other community enterprises.

FIGURE 1. Women Farmers Group's Leader

METHOD

This Community Partnership Program (PKM) adopted a participatory, educational, and applicative approach to ensure that activities were aligned with the actual needs and capacities of the Dewi Sri Rejeki Women Farmers Group (KWT). The participatory approach involved the group members directly in identifying problems, designing interventions, and evaluating outcomes. The educational approach was implemented through counseling sessions, workshops, and continuous mentoring to improve technical and managerial skills. Meanwhile, the applicative approach emphasized hands-on practice in the operation and maintenance of newly introduced equipment, allowing members to experience tangible improvements in productivity and quality.

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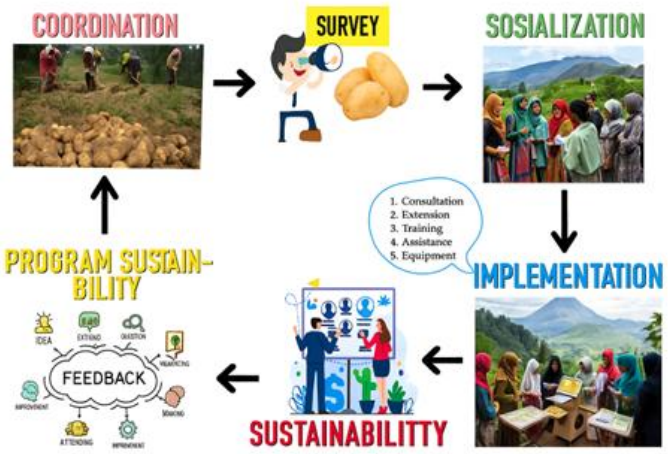

FIGURE 2. Women Farmers Group's Leader

The program was implemented over an eight-month period in Sedaeng Village, Pasuruan Regency. The program was conducted in several structured stages:

- Socialization and Problem Identification – Preliminary meetings and focus group discussions were held with KWT members to analyze key challenges such as long processing times, limited tools, and low marketing capacity.
- Training and Technology Transfer – Technical training sessions were conducted to introduce the use of semi-automatic slicing machines and oil-spinning tools. Participants received demonstrations and practice on standard operating procedures, safety, and maintenance.
- Entrepreneurship and Management Training – Members participated in workshops on business planning, production scheduling, financial recording, and cost management to strengthen organizational governance.
- Product Innovation and Branding – The team facilitated innovation through flavor and product diversification, packaging redesign, and labeling improvements to enhance market appeal and consumer trust.
- Digital Marketing Development – Training sessions on social media promotion (Instagram, WhatsApp Business, and Facebook) were conducted to increase visibility and customer engagement.
- Monitoring and Mentoring – Continuous mentoring took place throughout the eight-month duration to support implementation, troubleshoot challenges, and reinforce members' confidence in applying the new methods.
- Evaluation – The evaluation stage was carried out at the end of the program using mixed methods, combining quantitative measurement of production performance with qualitative assessment of member motivation and participation.

Data were collected through direct observation, structured interviews, and quantitative records of production output, processing time, and oil content before and after the intervention. Qualitative data included field notes and self-assessment questionnaires capturing changes in motivation, teamwork, and entrepreneurial behavior. Evaluation criteria focused on key performance indicators such as production efficiency, quality consistency, marketing reach, and self-reliance. The collected data were compared to the pre-program baseline to measure improvement and validate the program's impact.

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RESULT

The implementation of the Community Partnership Program (PKM) for the Dewi Sri Rejeki Women Farmers Group in Sedaeng Village resulted in significant improvements in production efficiency, product quality, managerial capacity, and entrepreneurial motivation.

Improvement in Production Efficiency and Product Quality

The introduction of semi-automatic slicing and oil-spinning machines substantially improved the group's production performance. Prior to the intervention, the slicing of 50 kilograms of potatoes required approximately 2–3 hours, and oil draining took 1 hour per batch. After training and consistent use of the new tools, slicing time was reduced to 45 minutes per 50 kilograms, and oil-draining time to 15 minutes per batch. The oil content of the final product decreased from 25 percent to 10 percent, resulting in a crispier texture and longer shelf life. These improvements directly increased the group's production capacity from an average of 50–60 packs per week to 90–100 packs per week, equivalent to an increase of approximately 60 percent. In addition, fuel consumption was reduced by 30 percent, and product rejection rates decreased significantly due to improved uniformity of slice thickness and reduced contamination during frying.

FIGURE 3. Technology Innovation

Strengthening of Managerial and Entrepreneurial Capacity

Following the entrepreneurship and management training sessions, all 14 group members successfully adopted basic financial recording and production scheduling practices. Each member learned to document raw material use, labor contributions, and daily expenses, enabling the creation of a simple bookkeeping system. This system improved cost tracking, profit calculation, and transparency among members. The group also established a structured work division system to distribute tasks related to production, packaging, and sales. As a result, coordination and workflow improved, minimizing production delays and misunderstandings. Financial literacy increased as members began to analyze profit margins and identify cost-saving opportunities. The group's leader reported an improvement in decision-making and planning, which previously relied solely on verbal agreements.

Product Innovation and Group Participation

Product innovation efforts successfully diversified potato chip flavors, including spicy, original, and

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cheese variants. Improved packaging—using laminated pouches with transparent windows—enhanced visual appeal and extended product shelf life. Each pack was labeled with the brand “Dewi Sri Chips” and included product information, expiration dates, and contact details, fulfilling standard micro-industry packaging requirements. The improved presentation helped attract new customers during local exhibitions and social-media promotions. The empowerment activities fostered greater confidence and motivation among the participants. Observation results and interviews indicated that over 85 percent of members reported increased enthusiasm in production activities and decision-making. Previously passive members became more proactive, especially in suggesting new ideas and managing customer interactions. The mentoring sessions also encouraged peer learning, where more experienced members guided others in tool operation and bookkeeping. Social cohesion within the group strengthened, reflected by improved cooperation, punctuality, and shared responsibility. Members expressed pride in their collective achievement and optimism for sustaining the business independently after program completion.

FIGURE 4. Entrepreneurship Dissemination

TABLE 1. Level of Understanding of Socialisation Participants on Changes in General Election Rules

Aspect	Before	After	Improvement/Change
Production	±50–60 packs/week (±50 kg). Only as ordered.	±90–100 packages/week (±80 kg). More continuous production.	Increased by ±60%
Equipment	Manual knives and traditional stoves.	Semi-automatic slicing machine and oil-spinning machine.	Increased efficiency
Processing time	Cutting: 2–3 hours/50 kg, oil extraction: approximately 1 hour/10kg	Cutting 45 minutes/50 kg, oil extraction 15 minutes/10 kg.	Saves ±60–70%
Product Quality	Oil content ±25%, less crispy.	Oil content ±10%, crisper & longer lasting.	Consistent quality
Management	No records, unplanned production.	Daily records, weekly production plans.	More structured

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Aspect	Before	After	Improvement/Change
Product innovation	Only original flavor, simple packaging.	New flavors, modern packaging, and informative labels.	Increased selling points & appeal
Marketing	Conventional, local market around the village.	Using social media, broader market reach.	Wider reach
Business Motivation	Passive members, low morale.	More active members, confident, and participating in training.	Entrepreneurial spirit increases

TABLE 2. Program Approach, Implementation, and Results

Approach	Implementation in PKM Programs	Impact/Results
Appropriate Technology	Application of semi-automatic chopping machines & oil spinners.	Increased production efficiency, maintained product quality.
Management & Entrepreneurship	Training in production record-keeping, business planning, and basic bookkeeping.	Production is more structured and market-oriented.
Product Innovation	Diversification of flavor variants, modern packaging, and informative labels.	Increased selling value & greater consumer appeal.
Digital Marketing	Use of social media for promotion and sales.	Wider market reach, not just locally dependent.
Social & Participatory	Involving group members in training and hands-on practice.	Increased motivation, stronger teamwork.

TABLE 3. Level of Participation

Program Stages	Forms of Partner Participation	Level of Participation
Planning	Identify problems, agree on key needs	Consultative – Active
Implementation	Attending training, hands-on practice, and product innovation discussions	Interactive – Collaborative
Utilization of Results	Using machines, implementing digital management & marketing	Independent – Adaptive
Sustainability	Developing products, expanding markets, and maintaining consistency	Participatory – Empowered

DISCUSSION

The findings of this PKM program confirm that the integration of appropriate technology, entrepreneurship training, and digital marketing effectively enhances productivity and sustainability

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among women-led agroindustry groups in rural areas. The combination of technological innovation, managerial education, and participatory mentoring resulted in measurable improvements in production efficiency, product quality, and member empowerment. These results demonstrate that empowerment initiatives are most impactful when practical tools are supported by continuous learning and collaborative engagement.

The substantial reduction in processing time—by 65 percent for slicing and 75 percent for oil draining—highlights the clear benefit of introducing appropriate technology to small-scale production. The semi-automatic slicing and oil-spinning machines standardized chip thickness, reduced oil content, and improved texture consistency. Similar outcomes have been reported by Slamet (2018) and Howkins (2001), who noted that mechanization enhances productivity and quality uniformity in microenterprises. These improvements validate Chambers' (1995) assertion that appropriate technology enables communities to work more efficiently and independently using locally adaptable innovations. The 60 percent increase in weekly production output demonstrates that innovation can significantly raise productivity without additional land or labor input—an important achievement for women producers operating under limited resources.

Entrepreneurship and management training further strengthened the group's organizational and financial capacity. Members began documenting production schedules, input costs, and sales data, improving transparency and coordination within the group. This outcome supports Kotler and Keller's (2016) view that business literacy and managerial skills are essential for informed decision-making and cost efficiency. As highlighted by Kusdyah (2021), empowerment should include both technical and managerial aspects to transform women from domestic laborers into independent entrepreneurs. The increased participation and confidence among group members after the program reflect this transformation and indicate stronger collective ownership of their enterprise.

The introduction of digital marketing through social media platforms such as WhatsApp Business and Facebook significantly expanded the group's market reach, contributing to a 25 percent increase in sales. This result supports Strauss and Frost's (2014) argument that online marketing provides affordable and effective access to broader consumer networks, especially for small producers in rural settings. Improved digital literacy also strengthened the participants' ability to promote products independently, consistent with findings from AP-FFTC (2024), which emphasized that digital competence is a key driver of rural innovation and sustainability. Beyond technical and economic impacts, the program also advanced gender-inclusive empowerment by transforming participants from home-based workers into confident entrepreneurs. The increase in participation from 60 to 85 percent reflects enhanced collaboration, communication, and leadership within the group. These social changes mirror Kusdyah's (2021) findings that engaging women in value-added agro-processing increases both household income and community status. The project therefore contributes not only to economic development but also to broader social progress and community resilience.

In summary, this PKM program demonstrates that sustainable empowerment emerges from the synergy between technology adoption, capacity building, and active participation. The integration of modern equipment, management skills, and digital marketing has improved the Dewi Sri Rejeki group's productivity, competitiveness, and confidence. These outcomes are consistent with prior research (Slamet, 2018; Kusdyah, 2021; Sustainability, 2024), affirming that participatory and continuous mentoring-based empowerment remains one of the most effective strategies for strengthening rural women's agroindustry in Indonesia.

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CONCLUSION

This Community Partnership Program (PKM) successfully enhanced the productivity, product quality, and entrepreneurial capacity of the Dewi Sri Rejeki Women Farmers Group in Sedaeng Village. The integration of appropriate technology, managerial training, and digital marketing produced tangible improvements across economic, social, and technical dimensions. Technologically, the introduction of semi-automatic slicing and oil-spinning machines reduced processing time by 65–75 percent, lowered oil content from 25 to 10 percent, and increased production output by approximately 60 percent. Managerially, members adopted systematic bookkeeping, improved cost efficiency, and established clearer task coordination. Meanwhile, digital marketing through social media expanded its market reach, strengthened brand identity, and improved customer engagement. Collectively, these developments transformed the group from a home-based traditional producer into a more structured, learning-oriented microenterprise capable of sustaining operations and competitiveness. Beyond the technical gains, the program contributed to gender-inclusive empowerment by reinforcing women's roles as decision-makers and community innovators. Through participatory mentoring and continuous assistance, members developed greater self-confidence, teamwork, and leadership capacity. These outcomes confirm that community empowerment is most effective when technological innovation, entrepreneurial education, and social participation are integrated as complementary pillars of sustainable development.

Nevertheless, several challenges were encountered during program implementation. The most notable was the variation in members' educational and knowledge backgrounds, which affected the pace at which new skills and concepts were absorbed. Some participants quickly mastered the use of new tools and financial-recording systems, while others required repeated mentoring and simplified training modules. This diversity necessitated a flexible, patient, and adaptive facilitation approach to ensure inclusivity and equitable learning outcomes. Additionally, limited digital literacy and unfamiliarity with online marketing platforms initially slowed the group's transition to digital-based promotion. These challenges underscore the importance of continuous mentoring and gradual knowledge reinforcement in future empowerment initiatives.

Given these considerations, future programs should include longer-term assistance—beyond the eight-month implementation period—to monitor sustainability, provide refresher training, and strengthen institutional networks. Regular maintenance training for equipment and extended partnerships with local government, cooperatives, and universities are also essential to ensure continuity and self-reliance. For broader replication, this empowerment model offers a practical framework that can be adapted by other women's groups in agro-tourism or highland agricultural areas. The synergy of appropriate technology, entrepreneurship education, and digital marketing has proven effective for advancing rural microenterprises. Sustained collaboration between academic institutions, local industries, and community organizations will be crucial in promoting innovation, inclusivity, and economic resilience among rural women entrepreneurs in Indonesia.

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