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Strengthening Economic Self-Reliance through Organic Fertilizer Processing and Digital Marketing at PKBM Al-Mu'thi Sleman

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A R T I C L E I N F O

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A B S T R A C T

This community service program aims to strengthen community economic self-reliance by empowering students and institutional managers through organic fertilizer production and digital marketing development. The program employed a participatory empowerment approach based on learning by doing, involving socialization, technical training, appropriate technology application, mentoring, and evaluation. Activities focused on improving fertilizer processing skills, establishing standard operating procedures, introducing quality control and financial recording practices, developing product packaging, and strengthening digital marketing capabilities. The results demonstrated improved technical competencies among participants, the availability of standardized production guidelines, better business administration readiness, and the development of WIMAYA GREEN as a marketable product identity. Furthermore, active participation encouraged entrepreneurial awareness, practical learning, and collaborative business management.

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INTRODUCTION

Community empowerment is an important approach to sustainable economic development because it positions communities as the primary actors in resource utilization, skill development, and the creation of poductive economic activities. Empowerment is not solely directed toward increasing income but also toward strengthening the capacity of individuals and groups to identify potential opportunities, manage resources, make decisions, and develop businesses independently. Within the context of the green economy, community empowerment can be achieved through the development of business activities that utilize local resources and transform waste into economically valuable products. This approach aligns with the principles of the circular economy, which emphasize resource efficiency, waste reduction, and value creation through productive activities (Agustina et al., 2025). Recent studies on converting organic waste into fertilizer indicate that implementing circular economy principles requires attention to technological aspects, sustainable management practices, and capacity development to ensure that waste-processing activities can be maintained over the long term (An et al., 2025). One practical application of the green economy at the community level is the development of organic fertilizer enterprises based on locally available resources. Such activities have strategic value because they not only involve the utilization of agricultural and livestock waste but also create opportunities for developing vocational skills, entrepreneurship, and productive community enterprises. Nevertheless, the availability of raw materials and equipment does not necessarily guarantee business success without adequate processing skills, standardized production systems, financial management, and product marketing capabilities. Therefore, the development of organic fertilizer enterprises should be viewed as an economic empowerment process that integrates technical, managerial, and marketing competencies. Through this approach, communities can acquire knowledge of organic material processing while developing enterprises that can be managed independently.

PKBM Al-Mu'thi, located in Sumberagung, Moyudan, Sleman, Special Region of Yogyakarta, Indonesia, is a community-based non-formal education institution with the potential to develop productive economic activities through organic fertilizer production. The institution possesses approximately 6,000 square meters of land, three greenhouses, sources of organic materials, and several fertilizer-processing machines, including shredders, dryers, screening machines, and granulators. In addition, its students (santri) and administrators represent valuable human resources who can participate in production activities and business development. These resources provide opportunities for PKBM Al-Mu'thi to integrate vocational learning with entrepreneurial practice. Developing an organic fertilizer enterprise within a non-formal education institution can also serve as a form of experiential learning that enables participants to acquire practical skills, understand business processes, and develop a sense of responsibility in managing economic activities.

Despite having considerable resources, the initial assessment revealed several challenges in organic fertilizer production at PKBM Al-Mu'thi. Production activities had not been consistently implemented in accordance with standard operating procedures, indicating the need to improve product quality and uniformity. Existing equipment had not been optimally utilized because of limited skills in machine operation and maintenance. From a managerial perspective, production records, costs, income, and sales had not been systematically documented, making it difficult for administrators to evaluate business development. Furthermore, product marketing remained limited due to the absence of a well-established brand identity, adequate packaging, and consistent digital media management. These conditions indicate a gap between the resources available to the partner institution and its capacity to transform them into productive economic activities. Thus, the principal challenge was not a lack of assets but rather the need to strengthen human resource capabilities and improve business management systems.

Addressing these challenges requires an empowerment approach that goes beyond providing technology and emphasizes improving community members' ability to use, manage, and develop technology independently. Chambers (1994) explains that participatory approaches provide opportunities for communities to engage in problem identification, planning, and activity implementation according to local needs. Similarly, Pretty (1995) and Agustina et al. (2025) emphasize the importance of participatory learning in building community knowledge and capabilities to support the sustainability of productive activities. In the context of PKBM Al-Mu'thi, this approach is particularly relevant because the participation of students and administrators is required throughout the production process, from material preparation and machine operation to quality control, packaging, and marketing. Through experiential learning based on direct practice (learning by doing), knowledge transfer is expected to extend beyond theoretical understanding and develop into practical skills applicable to everyday business activities.

Recent Community empowerment further highlights the importance of integrating local resource utilization with business system development. Miao and Zeller (2025), in a study published in Science of the Total Environment, explain that converting waste into fertilizer products is part of implementing circular economy principles and requires appropriate process management and technology selection. Their findings suggest that the success of waste utilization should not be assessed solely in terms of the ability to produce marketable products but should also consider the sustainability of the processing system. In the context of community empowerment, these findings reinforce the importance of process standardization, improved technological operating skills, and consistent production management. However, unlike studies focusing primarily on environmental assessment or waste-processing technology, the community service program at PKBM Al-Mu'thi emphasizes strengthening the capacity of students and administrators to manage locally based enterprises in a more organized and sustainable manner.

In addition to strengthening production capacity, the sustainability of community enterprises requires management and marketing capabilities that respond to developments in the digital business environment. Digital marketing provides opportunities for small businesses to introduce products, establish communication with consumers, and expand market reach without relying entirely on conventional marketing methods. However, the effective use of digital platforms requires skills in preparing product information, creating promotional content, understanding consumer needs, and maintaining consistent customer interactions. Hazzam et al. (2026), in a study published in the Journal of Research in Marketing and Entrepreneurship, demonstrate that digital marketing capabilities contribute to the performance of small and medium-sized enterprises and complement customer relationship management capabilities. These findings emphasize that digital marketing involves more than simply using social media; it also represents the development of organizational capabilities to understand markets and build customer relationships. Accordingly, improving digital marketing skills is an important component of community economic empowerment, particularly for groups with promising products but limited capacity to develop market access.

Integrating production improvement and digital marketing is particularly important in community service programs because both aspects reinforce each other in supporting business sustainability. Products manufactured through improved production processes may still face limitations in generating economic value if they lack recognizable identities, appropriate packaging, and effective marketing channels. Conversely, promotional activities may not deliver optimal benefits when product quality and business management capabilities have not been consistently developed. Based on these considerations, the empowerment program at PKBM Al-Mu'thi was designed to strengthen organic fertilizer production skills, optimize the utilization of appropriate technology, establish standard operating procedures, introduce business recordkeeping, and develop product branding and digital marketing capabilities. The development of the WIMAYA GREEN brand represents an initial effort to establish a recognizable product identity, while training in packaging, content creation, and digital platform utilization is intended to improve the institution's readiness to introduce its products to broader markets. All activities involve the direct participation of students and administrators so that the knowledge and skills acquired can be incorporated into the institution's regular productive activities.

Based on the preceding discussion, this community service program aims to strengthen the economic self-reliance of PKBM Al-Mu'thi by empowering its students and administrators through organic fertilizer production, improved business management, and digital marketing development. The program is expected to enhance technical skills, foster an entrepreneurial mindset, improve business management practices, and strengthen the community's readiness to develop sustainable productive economic activities. Its principal contribution lies in an integrated empowerment approach that combines production technology, human resource capacity development, business governance, and digital marketing within a community-based participatory framework. Therefore, the

program is intended not merely to produce organic fertilizer but also to strengthen the community's capacity to transform local resources into entrepreneurial activities with the potential for independent and sustainable management.

IMPLEMENTATION AND METHODS

Activity Design and Approach

This community service program employed a participatory empowerment approach that integrated socialization, training, demonstrations, hands-on practice (learning by doing), the application of appropriate technology, mentoring, and evaluation. This approach positioned community members as the primary actors in capacity-building activities, from identifying problems to applying the skills acquired during the program. Wijayanti et al. (2025) applied a Participatory Action Research (PAR) approach to empower enterprises engaged in processing shallot waste into organic fertilizer through socialization, training, mentoring, and evaluation. A similar approach was adopted by Hidayatullah et al. (2025) and Agustina et al. (2025), who combined educational sessions, practical training in the production of organic fertilizer using local microorganisms, and digital marketing assistance to improve community members' productive skills.

The program was designed based on the challenges faced by PKBM Al-Mu'thi, including the suboptimal utilization of fertilizer-processing machinery, inconsistent implementation of production procedures, inadequate business recordkeeping, and underdeveloped digital marketing practices. Accordingly, the program integrated improvements in production skills, standardization of processing procedures, strengthening of business management, development of product identity, and expansion of market access. Aminatun et al. (2026) demonstrated the relevance of integrating organic fertilizer production technology training with digital marketing in farmer empowerment activities in Kulon Progo. The integration of technical and marketing competencies provided the foundation for developing activities that extended beyond product manufacturing to enhance the community's readiness to manage economic activities independently.

Location, Target Participants, and Activity Resources

The community service program was conducted in 2026 at PKBM Al-Mu'thi, located in Celungan, Sumberagung, Moyudan District, Sleman Regency, Special Region of Yogyakarta, Indonesia. The program targeted administrators and students (santri) involved in agricultural activities, organic fertilizer production, and the development of productive business units. PKBM Al-Mu'thi has approximately 65 students, including 18 boarding students, and possesses approximately 6,000 m² of land, three greenhouses, organic raw materials, and fertilizer-processing facilities. These resources provided a foundation for developing productive learning activities based on local potential.

The materials used in the program were obtained from organic resources available through the partner institution's agricultural and livestock activities. The main equipment included a shredding machine, an open rotary dryer, a screening machine, and a granulator. Each machine served a specific function in the production process, including reducing material size, drying, screening, and forming granules. In addition to physical equipment, the program utilized standard operating procedure (SOP) guidelines, production and financial recordkeeping templates, packaging materials, and digital devices for marketing content development. The utilization of local resources through training and mentoring in organic fertilizer production was also implemented by Utami et al. (2025), who integrated the introduction of materials and equipment, instructional sessions, and direct demonstrations to improve participants' skills in processing locally available organic materials.

Methods and Stages of Program Implementation

The program was implemented through five interconnected stages: socialization and needs assessment, training and skills development, application of appropriate technology, mentoring and evaluation, and strengthening business sustainability. These stages were adapted from community service approaches implemented by Wijayanti et al. (2025), Utami et al. (2025), and Analisa et al. (2026), which emphasize the connections between needs identification, practical training, program implementation, and empowerment evaluation. The first stage involved socialization and assessment of the partner institution's needs. The program began with coordination among the community service team, PKBM Al-Mu'thi administrators, and students to establish a shared understanding of its objectives, benefits, and implementation procedures. The needs assessment was conducted through observations of production facilities, discussions with administrators, and reviews of existing organic fertilizer processing activities. The assessment covered raw material availability, machinery utilization, production procedures, product quality, business recordkeeping, and marketing activities. This stage was consistent with Utami et al. (2025), who incorporated needs identification, preparation of tools and materials, and site selection as preliminary activities before training and mentoring. The information obtained was used to develop training materials and determine intervention priorities based on the partner institution's actual needs.

The second stage focused on training and skills development. Training was conducted through instructional presentations, demonstrations, discussions, and hands-on practice involving students and administrators. Technical training covered organic material sorting, shredding, fermentation, drying, screening, granule formation, packaging, and the introduction of quality control procedures. Training also included basic machinery operation and maintenance to ensure that participants understood proper equipment use. This hands-on learning approach was consistent with Utami et al. (2025), who combined instructional sessions and organic fertilizer production demonstrations to improve participants' understanding and practical skills. Aminatun et al. (2026) similarly implemented training and mentoring in compost production using

locally available agricultural waste as part of community-based organic farming development. In addition to technical training, participants received instruction in business management, including recording raw material usage, production quantities, operating costs, income, expenditures, and sales. Digital marketing training introduced product branding, product photography, description writing, and promotional content development for social media. Hidayatullah et al. (2025) demonstrated that organic fertilizer production training combined with assistance in using digital marketing platforms can help communities develop both production and marketing capabilities. Thus, the training was designed not only to improve fertilizer production skills but also to establish foundational knowledge of entrepreneurship and market management.

The third stage involved the application of appropriate technology and product development. This stage consisted of hands-on practice using organic fertilizer processing machinery according to the production workflow developed with the partner institution. The process began with material sorting, followed by shredding, fermentation, drying, screening, granule formation, and packaging. Basic quality control was conducted by observing product dryness, texture, cleanliness, color, odor, and uniformity. The application of technology was intended to improve machinery operating skills and establish more structured production practices. Wijayanti et al. (2025) reported the implementation of machinery training combined with management and marketing development in an organic fertilizer enterprise utilizing shallot waste. Their findings highlight the importance of integrating technological competencies with managerial skills in enterprise empowerment programs. Product development activities included establishing the WIMAYA GREEN brand identity and introducing 5 kg organic fertilizer packaging. These activities were accompanied by the development of product photographs, descriptions, and digital marketing content. Wanita et al. (2024) implemented branding management and digital marketing strategy training to strengthen farmer groups' capacity to market organic fertilizer products. Similarly, Analisa et al. (2026) integrated fertilizer production training, packaging, labeling, and digital media utilization into community empowerment activities. Based on these approaches, product development at PKBM Al-Mu'thi was directed toward improving market readiness and strengthening the partner institution's business identity.

The fourth stage involved mentoring and program evaluation. Mentoring activities were conducted to strengthen participants' ability to apply the knowledge and skills acquired during training. These activities included reinforcing SOP implementation, practicing machinery operation, applying basic quality control procedures, using production and financial recordkeeping templates, and developing digital promotional materials. Evaluation was conducted through direct observation, discussions, documentation, and assessment of practical outputs to identify changes in participants' capabilities and remaining challenges. A similar method was implemented by Analisa et al. (2026), who employed observation, preparation, training, monitoring, and evaluation in community empowerment activities related to organic fertilizer

production and digital marketing. Wijayanti et al. (2025) also conducted evaluations to examine changes in participants' knowledge of production management, finance, marketing, and machinery operation.

The fifth stage focused on strengthening business sustainability. Activities were directed toward establishing operational systems that would enable the partner institution to continue organic fertilizer production and product marketing after the mentoring period ended. These efforts included encouraging consistent SOP implementation, introducing the division of responsibilities for production, packaging, administration, and marketing, and promoting continuous business recordkeeping. Administrators were also encouraged to prioritize machinery maintenance, product quality consistency, and the development of digital marketing activities. Hidayatullah et al. (2025) identified community capabilities in fertilizer production and marketing platform utilization as important components of local economic self-reliance. Meanwhile, Aminatun et al. (2026) demonstrated that organic farming assistance can be combined with marketing development to strengthen communities' ability to manage productive economic activities.

Evaluation of Community Service Program Outcomes

The evaluation of the community service program focused on assessing the achievements, benefits, and changes resulting from the empowerment activities implemented at PKBM Al-Mu'thi. The evaluation was conducted by examining the extent to which the program improved participants' technical skills, business management capabilities, entrepreneurial competencies, and readiness to develop sustainable economic activities. The evaluation emphasized the practical outcomes of the training, technology application, and mentoring activities, particularly their contribution to strengthening the capacity of students and administrators to manage organic fertilizer production and marketing independently. This approach is consistent with Utami et al. (2025) and Wijayanti et al. (2025), who emphasized improvements in participants' knowledge, practical skills, and business management capabilities as important indicators of community service program achievements.

The evaluation covered four main dimensions of community empowerment: technical capacity, managerial capacity, learning participation, and economic readiness. Technical capacity was evaluated based on participants' ability to operate fertilizer-processing machinery, implement standard operating procedures (SOPs), and perform basic product quality control. Managerial capacity was assessed through the establishment and application of production and financial recordkeeping practices. Learning participation was evaluated through the active involvement of students in fertilizer production, packaging, and promotional activities. Economic readiness was assessed based on the development of the WIMAYA GREEN product identity, improved packaging, and the utilization of digital marketing platforms. These evaluation dimensions align with Hidayatullah et al. (2025), who highlighted the importance of production competencies, entrepreneurial skills, and digital marketing capabilities in strengthening community economic empowerment.

The evaluation also considered the sustainability of program outcomes, particularly the partner institution's ability to maintain production activities, apply operational procedures consistently, manage business operations, and continue digital marketing initiatives after the mentoring period. The production target of 100–300 kg per month and the development of two active digital marketing channels were established as indicators for subsequent evaluation rather than achievements already confirmed. Attention was given to identifying remaining challenges, including consistency in product quality, machinery maintenance, routine business recordkeeping, and continuity of marketing activities. Overall, the evaluation was intended to assess not only the immediate outcomes of the community service program but also its contribution to strengthening institutional capacity, entrepreneurial independence, and the long-term sustainability of community-based organic fertilizer enterprises.

RESULTS AND DISCUSSION

The outcomes of the community service program at PKBM Al-Mu'thi, Celungan, Sumberagung, Moyudan, Sleman, are presented in the sequence of implementation: socialization and needs assessment; technical training in fertilizer processing; technology application and quality control; product development and business recordkeeping; digital marketing; and evaluation and sustainability planning. This sequence allows the changes experienced by the partner institution to be traced from its initial conditions to outcomes substantiated by practice, documents, products, and photographic records. The report underlying this article is a progress report; therefore, outcomes lacking quantitative evidence are not presented as achieved targets. Table 1 summarizes the implementation stages, key activities, and outputs. The source report does not specify the dates or number of meetings for each stage.

Table 1. Schedule of Activities By Program Stage

Program Stage	Main Activities	Observed Outputs
1. Socialization and assessment	Coordination, observation, and discussion of partner needs	Priority areas for mentoring identified
2. Training and production practice	Introduction to SOPs, sorting, shredding, fermentation, drying, screening, and granulation	SOPs available; machinery use practiced.
3. Product development and administration	Quality control, packaging, introduction to recordkeeping templates	WIMAYA GREEN packaging and recordkeeping templates available
4. Digital marketing training	Product photography, descriptions, and promotional social media content	Promotional materials initiated

5. Mentoring and evaluation	Observation of practice, discussion of challenges, review of outputs and follow-up actions	Achievements and further support needs identified

Source: Compiled from the Sequence of Activities in the PKBM Al-Mu'thi Community Service Report, 2026.

Socialization and Coordination

The program began with socialization and coordination between the community service team and the administrators and students of PKBM Al-Mu'thi. The activities introduced the program objectives and discussed constraints in organic fertilizer processing and business development. Initial observations showed that the partner already possessed approximately 6,000 m² of land, three greenhouses, locally available organic materials, and fertilizer-processing equipment. The principal difficulties instead concerned management of these resources: work procedures were not fully standardized, machinery was underutilized, production and financial records were not routinely maintained, and the product lacked adequate branding and promotion. The initial stage identified five priorities for mentoring: standardization of the production workflow, equipment operation skills, quality control, business administration, and marketing. The involvement of administrators and students in initial coordination was important because they understood on-site conditions and could help assess whether the training materials addressed their needs. This activity is illustrated in Figure 1.



Figure 1. Socialization and Coordination With PKBM Al-Mu'thi Administrators and Students

Source: Community Service Team Documentation, 2026.

Training and Practical Organic Fertilizer Processing Stage

During the training stage, participants received explanations of organic material sorting, shredding, fermentation, drying, screening, granule formation, and packaging. Instruction was accompanied by demonstrations and hands-on practice to enable students and administrators to understand the function of each stage and the relationships among processes. Rather than merely introducing equipment, the training sought to establish an understanding of a workflow that the partner institution could repeat. Practical use of the shredding machine, open rotary dryer, screening machine, and granulator formed a central part of the training. The shredder reduced material size; the dryer helped reduce moisture content; the screen separated coarse material; and the granulator was used to

develop granular fertilizer. Participants were also introduced to basic equipment maintenance. Figure 2 illustrates the practical use of fertilizer-processing technology, while Figure 3 shows students participating in production activities.



Figure 2. Training and Practical Use of Organic Fertilizer Processing Machinery

Source: Community Service Team Documentation, 2026.

The most tangible outcomes of this stage were the availability of production guidelines and participants' hands-on experience in operating the machinery. Basic physical quality checks were introduced by examining dryness, texture, cleanliness, color, odor, and product uniformity. However, the granulation process still required refinement. The training outcomes are therefore more appropriately characterized as improvements in technical readiness rather than evidence that every process had become stable under routine production conditions.



Figure 3. Student Participation in Organic Fertilizer Processing Activities

Source: Community Service Team Documentation, 2026.

Product Development and Business Recordkeeping Stage

Following production practice, activities focused on strengthening the management of outputs. The partner institution was introduced to templates for recording raw materials, production quantities, costs, income, expenditures, and sales. These templates provide a basis for tracking activities in each production cycle while giving students practical experience in business management. At the reporting stage, the recordkeeping templates were available, but monthly production and sales records were not sufficiently complete to calculate economic performance accurately. As part of product downstream development, the WIMAYA GREEN identity and 5 kg organic fertilizer packaging were developed. The packaging serves as a means of storage and product communication. It shifts the orientation of output previously used largely within the institution toward a product being prepared for the market. The resulting packaging is shown in Figure 4.



Figure 4. Organic Fertilizer Packaging Featuring the WIMAYA GREEN Identity

Source: Community Service Team Documentation, 2026.

Digital Marketing Training Stage

Marketing activities introduced product photography techniques, product description writing, educational materials, and preparation of promotional content for social media. Students and administrators were encouraged to understand the information prospective customers need, particularly product identity, packaging format, and the uses of organic fertilizer. Figure 5 presents an example of social media use to introduce WIMAYA GREEN.



Figure 5. Example of Social Media Content Promoting WIMAYA GREEN
Source: Community Service Team Documentation, 2026.

The outcomes of this stage were the preparation of promotional materials and the initial use of digital media for product communication. However, the target of actively and consistently managing two digital channels still requires monitoring. The source document does not provide time-series evidence of account reach, inquiries from prospective customers, transaction numbers, or the contribution of digital channels to revenue. Accordingly, these outputs are not interpreted as a measurable increase in sales.

Evaluation and Review of Program Outcomes Stage

The progress-stage evaluation examined the implementation of practical activities, the outputs produced, and the availability of supporting documents. Changes in the partner institution's work practices are summarized in Table 2. The table indicates that the program generated several operational resources and opportunities for practical experience, although some indicators were still at an early stage of implementation.

Table 2. Changes in the Partner Institution's Work Practices During the Progress Stage

Aspect	Initial Conditions	Documented Outcomes
Production	Procedures were inconsistent	SOPs began to be implemented
Technology	Limited machinery utilization	Machinery operation practiced
Quality	Control procedures not standardized	Basic physical checks introduced
Administration	Records not systematically maintained	Production and financial templates available
Product	Limited identity and packaging	WIMAYA GREEN packaging developed

Marketing	Digital media not optimally utilized	Promotional materials and content initiated

Source: Adapted from Program Documentation and The Progress Report, 2026.

In addition to developing production skills, the fertilizer produced was used in cultivation activities. Application results reported in the progress document are presented in Table 3. Maize height under a treatment containing 50% compost and 50% livestock waste was 139.33 cm, compared with 101.00 cm under the no-compost treatment. These values are descriptive observations illustrating product use during practical learning activities. Information on replication, experimental design, and measurement procedures is insufficient to draw inferential conclusions regarding fertilizer effectiveness.

Table 3. Fertilizer Application Observations in Maize Cultivation

Treatment	Maize height (cm)
Without compost	101.00
100% compost	104.33
75% compost + 25% livestock waste	115.44
50% compost + 50% livestock waste	139.33
Phonska NPK	149.33

Source: Adapted from Program Documentation and the Progress Report, 2026.

Achievement against program targets is presented in Table 4. This summary distinguishes outputs already observed from sustainability indicators that could not yet be verified in the progress report.

Table 4. Actual Achievements and Aspects Requiring Follow-Up

Indicator	Progress-stage Status
SOPs and practical machinery operation	Available and practiced
Basic physical quality control	Introduced
WIMAYA GREEN identity and packaging	Available
Routine business recordkeeping	Needs to become regular and more complete
Production of 100–300 kg/month	Not yet verifiable
Two active digital marketing channels	Continued activity still needs verification.
Revenue and sales	Insufficient evidence available

Source: Adapted from Program Documentation and The Progress Report, 2026.

The findings indicate that the primary challenge faced by PKBM Al-Mu'thi was not the availability of resources but rather the limited capacity to organize these resources into a sustainable production and business system. Therefore, the stages of socialization, practical training, management strengthening, and promotional activities constituted an integrated process of capacity development for the partner institution. This interpretation is consistent with Chambers (1994); Pretty (1995) and Agustina et al. (2025), who emphasize community participation

and collaborative learning as essential components of empowerment, rather than merely the provision of physical assistance.

Significance of Skills Development and Technology Utilization

The involvement of students (santri) in hands-on machinery operation provided opportunities for productive learning within a non-formal educational environment. These activities enabled participants to gain direct experience in understanding production workflows and the functions of processing equipment. In terms of verifiable outcomes, the program documentation confirmed participants' involvement and the implementation of practical training activities. However, improvements in individual competencies had not yet been assessed using pre- and post-training evaluation instruments. The hands-on learning approach was grounded in experiential learning theory, which explains that knowledge is developed through experience, reflection, and practical application (Henríquez et al., 2025).

The standardization of operating procedures and introduction of basic quality control practices helped the partner institution establish more structured and replicable production processes. Nevertheless, the availability of standard operating procedures (SOPs) does not automatically demonstrate that all production processes comply with established quality standards. Product consistency needs to be evaluated through systematic production records, clearly defined quality acceptance criteria, and regular inspections. This consideration is particularly important because shredding machines, dryers, screening machines, and granulators can generate economic benefits only when they are utilized consistently and maintained appropriately.

Significance of Product Development, Business Administration, and Marketing

The development of the WIMAYA GREEN brand and 5 kg packaging represented important achievements in product commercialization and value-added development. The products began to acquire a recognizable identity, while digital promotional materials supported broader dissemination of product information. Community service studies by Syahputra (2024) and Wanita et al. (2024) similarly identified packaging development, brand strengthening, and digital marketing as important components of business assistance programs for organic fertilizer enterprises. These similarities suggest that the PKBM Al-Mu'thi program successfully integrated production and marketing activities, although its actual sales performance still requires verification through systematic transaction records.

Furthermore, production and financial recordkeeping templates represent managerial tools that are equally important as physical production equipment. Systematic recordkeeping enables administrators to calculate production costs per kilogram, identify changes in production volumes, and evaluate sales performance. Without consistent records, claims regarding increased income or financial independence would be premature. Similarly, the effectiveness of the two planned digital marketing channels can only be assessed once information on account activity, customer inquiries, and transactions becomes available. Studies by Jadhav et al. (2023) and Sharabati et al. (2024) provide evidence that

digital marketing can support business performance, although its benefits depend on the capabilities of business operators to manage digital marketing activities effectively.

Empowerment Benefits, Supporting Factors, and Implementation Challenges

The identifiable benefits of the program included expanded opportunities for students to acquire practical experience in production and promotional activities, the availability of basic operational tools for administrators, and the establishment of an organic fertilizer product identity. The program's main contribution was the strengthening of technical and managerial capacities, entrepreneurial learning, and market readiness. The utilization of organic waste was also relevant to resource efficiency and circular economy principles. However, improvements in the partner institution's economic capacity cannot yet be equated with increased income because sufficient evidence of sales performance was not available in the program report. Several factors supported program implementation, including the availability of land, greenhouses, organic raw materials, processing equipment, institutional support from administrators, and active student involvement. Boarding students have the potential to participate in production activities more regularly. Meanwhile, the identified challenges included inconsistent SOP implementation, limited quantitative production records, machinery maintenance requirements, unstable granule production, and difficulties maintaining continuous digital content development and marketing activities.

These challenges explain why the production target of 100–300 kg per month and the establishment of two consistently active digital marketing channels could not yet be considered achieved at the progress-reporting stage. From a practical perspective, subsequent mentoring activities should focus on transforming the initial program outputs into measurable and consistent operational practices. Each production cycle should be systematically recorded, quality control results should be documented, responsibilities for machinery maintenance should be clearly assigned, and promotional content should be scheduled regularly. Assessing students' competencies before and after training, together with maintaining periodic sales records, would provide stronger evidence of the program's impact. Through these improvements, organic fertilizer enterprise development can progress beyond the availability of equipment and packaging toward more independent and sustainable business management. Furthermore, an empowerment model that integrates physical production technology with SOPs, basic financial recordkeeping, and digital communication skills has the potential to be adapted by other community-based educational institutions with similar organic resource potential.

CONCLUSIONS AND RECOMMENDATIONS

The community service program conducted at PKBM Al-Mu'thi, Sumberagung, Moyudan, Sleman, has contributed to strengthening the partner institution's capacity and economic self-reliance through the development of organic fertilizer production, the application of appropriate technology, business management, and digital marketing. The implementation of the program using a participatory approach and hands-on learning (learning by doing) encouraged the active involvement of students (santri) and administrators in organic material processing, machinery operation, the implementation of standard operating procedures (SOPs), basic quality control, and production and financial recordkeeping.

The development of the WIMAYA GREEN brand identity and product packaging, along with the creation of digital marketing content, represented initial steps toward improving the product's market readiness. In addition to strengthening technical and managerial skills, the program provided educational benefits through experiential entrepreneurship learning that connected local resource utilization with productive economic opportunities. Nevertheless, the program's achievements remain primarily focused on capacity building and business readiness. At the same time, the attainment of production targets, the sustainability of digital marketing activities, and increases in income have not yet been confirmed and require further monitoring and evaluation. Overall, the program has established a foundation for green economy-based community empowerment, with the potential to support sustainable enterprise development and strengthen the economic self-reliance of PKBM Al-Mu'thi.

For the administrators of PKBM Al-Mu'thi, program sustainability should be strengthened through consistent implementation of production SOPs, optimal utilization and maintenance of organic fertilizer processing machinery, and regular recording of production volumes, operating costs, and sales. Administrators should also establish a clear division of responsibilities covering production, quality control, packaging, administration, and marketing activities. Student participation in business management should be maintained as part of entrepreneurship education. At the same time, digital marketing activities for WIMAYA GREEN products should be further developed through regular content creation and expansion of marketing networks. For policymakers, particularly local governments and institutions responsible for non-formal education, agriculture, community empowerment, and microenterprise development, support is needed in the form of business mentoring, human resource capacity building, assistance with product quality testing and regulatory compliance, and improved market access. Such support is essential to encourage the development of community-based organic fertilizer enterprises that are competitive and capable of generating sustainable economic benefits.

Furthermore, community empowerment programs based on organic waste utilization could be considered a model for promoting green economy initiatives within non-formal educational institutions. For future community service practitioners, subsequent programs should focus on strengthening business sustainability through more structured and measurable mentoring activities, particularly in production capacity, product quality consistency, cost efficiency, and digital marketing effectiveness. Community empowerment evaluations should also incorporate assessments of participants' competencies before and after program implementation, production volumes, sales performance, and changes in business income. Strengthening collaboration among universities, government institutions, and business stakeholders is expected to expand the program's reach while contributing to the development of an economic empowerment model based on organic waste processing that can be replicated in other communities.

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