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Development of Community-Based Digital Marketing Training for Millenial Greenhouse Farmers in Panambangan Village

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Abstract

This study aimed to develop a community-based digital marketing training model using a Project-Based Participatory Training (PBPT) approach for millennial greenhouse farmers in Panambangan Village. The study was motivated by the relatively low level of digital technology adoption among farmers, particularly in the use of social media, online marketplaces, and product branding to market horticultural products. A descriptive qualitative approach was employed using a project-based and participatory training design. Data were collected through observation, interviews, documentation, and assessment of the projects completed by training participants. The findings showed that although farmers had access to digital technology, they lacked adequate skills to transform this access into productive marketing tools. The PBPT model, which integrated project-based learning with participatory methods, was developed through seven stages: identification of problems and needs, project planning, instruction and practice, project implementation, mentoring, evaluation, and follow-up. The training process produced concrete outputs, including digital business accounts, promotional content, digital catalogs, and a Digital Marketing Action Plan that could be implemented directly by participants. These findings indicated that a contextual, community-based training model could improve farmers' digital competencies, expand market access, reduce postharvest losses, and strengthen the competitiveness of millennial greenhouse farmers within an evolving digital economy. Therefore, the PBPT model has the potential to serve as a reference for developing digitally oriented farmer empowerment programs in other regions with similar social and economic characteristics while also contributing to research on community-based digital marketing training in the agricultural sector.

INTRODUCTION

The advancement of digital technology in the Industry 4.0 era has fundamentally transformed the marketing landscape for agricultural products, shifting marketing practices from conventional methods toward digital platform-based approaches. Digital marketing offers farmers substantial opportunities to expand market access, increase product value, and establish direct relationships with consumers. Nevertheless, empirical evidence consistently indicates that the adoption of digital technology among farmers, particularly smallholder farmers in developing countries, remains relatively low. This limited adoption has been attributed to multiple constraints, including inadequate digital competencies, insufficient digital literacy, and a limited capacity to use internet-based marketing channels effectively (Afridhianika & Yudhianto, 2025; Laelago Ersedo et al., 2023) . These limitations have

important implications for the competitiveness of agricultural products and the economic welfare of farming communities.

Global evidence indicates that the agricultural sector is undergoing rapid digital transformation. The Food and Agriculture Organization (2022) reported that digital technologies have the potential to transform agrifood systems by improving efficiency, transparency, and market connectivity. However, the same report highlighted that smallholder farmers in developing countries continue to face substantial barriers to technology adoption, including limited access to digital infrastructure, insufficient technical skills (Bell, 2010) , and inadequate institutional support. In the Indonesian context, the Ministry of Agriculture (2023) reported that only approximately 27% of farmers had used digital platforms to market agricultural products, while the majority continued to rely on traditional marketing channels (Cahya et al., 2024) . Furthermore, data from the Central Bureau of Statistics (2023) indicated that postharvest losses in Indonesia reached approximately 20–30% annually, a substantial proportion of which was associated with inefficient marketing systems and limited market access. These conditions underscore the need for interventions that can strengthen farmers' capacity to use digital technologies for marketing purposes.

In Panambangan Village, the development of greenhouse agriculture managed by millennial farmers presents a promising economic opportunity, particularly because of the village's horticultural production potential (Arvianti et al., 2022) . However, this potential has not been fully realized because of persistent marketing constraints. Harvests are not always fully absorbed by existing markets, resulting in quality deterioration and, in some cases, product spoilage. This situation is associated primarily with farmers' limited capacity to use social media, online marketplaces, and product branding strategies effectively. Marketing continues to depend largely on conventional channels, including sales to intermediaries and existing customers, which restricts market reach and may generate economic losses when production increases. These conditions demonstrate the need for practical capacity building that equips farmers not only with conceptual knowledge of digital marketing but also with the skills required to apply digital technologies directly to the marketing of greenhouse produce.

A substantial body of previous research has demonstrated the potential of digital marketing to strengthen the competitiveness of agricultural products. Suryani et al. (2022) found that digital marketing could significantly increase market reach, expand customer networks, and enhance the economic value of agricultural products. Putri and Prasetyo (2023) further reported that farmers who adopted digital marketing strategies experienced an approximately 35% increase in sales compared with those who relied solely on conventional methods. In the international context, Klerkx et al. (2019), in a Scopus-indexed study, emphasized that digital transformation in agriculture requires not only technological infrastructure but also substantial human-resource capacity building, particularly in digital literacy and entrepreneurial skills. Collectively, these findings suggest that successful digital marketing adoption among farmers depends not only on access to technology but also on appropriate training and capacity-building programs (Fharaz et al., 2022) .

Despite the growing literature on digital marketing in agriculture, a significant research gap remains in the development of community-based training models specifically designed for millennial greenhouse farmers in rural areas. Existing studies have primarily focused on digital technology adoption among large-scale farmers or agribusiness enterprises

(Klerkx et al., 2019; Suryani et al., 2022), with relatively limited attention to contextualized training models for smallholder farmers. Moreover, much of the previous research has examined digital marketing adoption primarily from a technological perspective rather than through participatory and competency-based approaches (Bennett et al., 2020) . The limited availability of structured training models that integrate project-based learning with participatory methods for greenhouse farming communities therefore represents an important gap addressed by this study. This gap is particularly relevant given the characteristics of millennial farmers, who may differ from previous generations in terms of learning preferences, familiarity with digital technologies, and entrepreneurial orientation.

The urgency of this research is reinforced by the accelerating digital transformation of the agricultural sector and the increasing pressure on farmers to respond to changing market dynamics. The COVID-19 pandemic further accelerated the shift toward digital platforms, as consumers increasingly purchased agricultural products online (FAO, 2021). Farmers who are unable to adapt to this transition risk becoming increasingly marginalized from higher-value markets, potentially exacerbating existing economic disparities in rural areas. In Panambangan Village, the risk of postharvest losses resulting from unabsorbed production constitutes a pressing challenge. Therefore, the development of a practical and contextualized digital marketing training model is essential for strengthening the sustainability and competitiveness of millennial greenhouse farmers within the evolving digital economy.

The novelty of this research lies in the development of the Project-Based Participatory Training (PBPT) model, which integrates project-based learning principles with participatory approaches tailored to the characteristics and needs of millennial greenhouse farming communities. Unlike conventional training models that focus predominantly on knowledge transfer, the PBPT model emphasizes hands-on practice, active participant involvement, and the production of tangible outputs, including digital marketing content and a Digital Marketing Action Plan. The model addresses limitations associated with conventional training approaches by promoting a learning process that is contextual, collaborative, and oriented toward practical application. In addition, the Digital Marketing Action Plan functions as a community-based marketing roadmap intended to support the continuity of digital marketing activities after the formal training period, thereby addressing the common challenge of post-training sustainability in community development programs.

This research aimed to develop a community-based digital marketing training model for millennial greenhouse farmers in Panambangan Village. Specifically, the study sought to: (1) identify the digital marketing training needs of millennial greenhouse farmers; (2) develop a PBPT model integrating project-based learning with participatory methods; (3) implement the training model and evaluate its effectiveness in improving participants' digital marketing competencies; and (4) formulate a Digital Marketing Action Plan to support sustainable community-based marketing. Through these objectives, the study sought to contribute to the development of practical and effective training models that could be adapted to other rural communities facing similar challenges.

The contributions of this research are both theoretical and practical. Theoretically, the study contributes to the literature on community-based training models, particularly in the context of digital marketing for smallholder farmers. It introduces the PBPT model as a framework that integrates project-based learning and participatory approaches within a rural

agricultural setting, thereby extending existing discussions on agricultural extension, digital capacity building, and community development. Practically, the research provides a training model, digital marketing materials, and a Digital Marketing Action Plan that can be used by farmer communities. The findings may also inform policymakers, agricultural extension workers, and community development practitioners in designing more effective digital marketing interventions for farmers.

Ultimately, this research sought to strengthen the digital competencies of millennial greenhouse farmers, facilitate the establishment of digital marketing channels managed by participants, and develop a community-based marketing roadmap. The potential benefits extend beyond the immediate participants by supporting broader market access, reducing losses associated with unabsorbed harvests, and strengthening the competitiveness and self-reliance of millennial greenhouse farmers within the evolving digital economy (Nations, 2021; Organization, 2022) . In addition, the research outputs, including scientific publications, training modules, and digital marketing materials, may serve as references for future studies and community development programs in similar settings. Through these contributions, the study is expected to support the capacity of millennial greenhouse farmers in Panambangan Village to navigate digital market environments and contribute to sustainable agricultural development in Indonesia.

METHOD

This study employed a qualitative descriptive approach with a project-based and participatory training design that was subsequently developed into the Project-Based Participatory Training (PBPT) model. The study involved millennial greenhouse farmers in Panambangan Village who were actively engaged in greenhouse horticultural production and had access to basic digital technology. Purposive sampling was used to select 20 participants based on their active involvement in greenhouse farming, age, access to smartphones and social media, and willingness to participate in the training program. Data were collected using observation sheets, semi-structured interview guides, digital marketing project assessment rubrics, and documentation checklists. Instrument validity was assessed through expert judgment involving specialists in agricultural extension, digital marketing, and community development. The credibility of the data was strengthened through triangulation and member checking.

The research procedure consisted of four main stages: needs analysis, model development, implementation, and evaluation. The needs analysis identified participants' digital marketing training needs through interviews, field observations, and focus group discussions. The PBPT model was then developed based on the needs analysis and relevant literature and comprised seven stages: problem and needs identification, project planning, instruction and practice, project implementation, mentoring, evaluation, and follow-up. The training was implemented through presentations, demonstrations, discussions, hands-on practice, group work, and mentoring. Evaluation focused on participants' practical performance and the quality of the digital marketing projects produced during the training. Data were collected through observations of practical activities, semi-structured interviews with participants and facilitators, documentation of training activities and project outputs, and assessments of participants' project outcomes. NVivo was used to support qualitative data

coding, while Microsoft Excel was used to organize assessment scores and project evaluation data.

Data were analyzed descriptively through data reduction, data display, and conclusion drawing. Digital marketing project assessments were also analyzed descriptively to determine participants' competency attainment based on practical performance and project quality. The assessment rubric covered target consumer identification, completeness of product information, promotional content quality, branding, use of digital media, marketing relevance, creativity, and project feasibility. The results of the analysis were used to evaluate and refine the PBPT model and to formulate the Digital Marketing Action Plan. Triangulation was conducted by comparing findings from observations, interviews, and documentation, while member checking was used to confirm the accuracy of the interpretations with participants.

RESULTS AND DISCUSSION

The research findings are presented in three main parts: the initial conditions and marketing challenges of millennial greenhouse farmers, the development of the PBPT model, and the changes in participant competence after training. The data were collected through observations, interviews, documentation, and assessments of participant project outcomes. Table 1 presents the assessment rubric for digital marketing competency attainment, which was used to evaluate the participants' practical performance and project outcomes. The rubric covers eight assessment aspects with a score range of 1 to 4, where a score of 1 indicates that the participant is not yet able to apply the competency being assessed, and a score of 4 indicates that the participant is able to apply the competency independently and excellently (Indonesia, 2023; Kokotsaki et al., 2016) . This rubric serves as the primary instrument for measuring the effectiveness of the PBPT model in enhancing the digital marketing competencies of millennial greenhouse farmers

Table 1. Assesment Rubric for Digital Marketing Competency Attainment

No	Assessment Aspect	Indicator	Score
1	Target Consumer	Accuracy in defining the target consumer	1-4
2	Product Information	Completeness and clarity of product information	1-4
3	Promotional Content	Quality of photos/videos and promotional messages	1-4
4	Branding	Application of identity and product unique selling points	1-4
5	Digital Media	Ability to utilize social media/marketplaces	1-4
6	Marketing Alignment	Alignment of content with the target consumer	1-4
7	Creativity	Creativity in content presentation	1-4
8	Project Feasibility	Suitability for use as a marketing medium	1-4

Source: Developed by the researchers based on the digital marketing competency assessment framework, 2026.

The analysis of the initial conditions revealed that millennial greenhouse farmers in Panambangan Village already possess access to and basic experience with digital technology, particularly smartphones and social media. However, the use of this technology has not yet been fully leveraged for marketing agricultural produce. Social media is generally used primarily for promotion and branding, while actual product sales remain limited. The issues identified relate not only to the limited use of digital media but also to the farmers' capabilities regarding product packaging and the communication of product value to consumers. Farmers still struggle with creating promotional content, capturing appealing product photos, drafting product descriptions, identifying target consumers, building brand identities, and selecting appropriate marketing channels. Furthermore, the marketing of harvests still largely relies on conventional channels, such as sales to traders or known consumers. This situation limits market reach; when production increases, the entire harvest cannot always be immediately absorbed by the market, creating a risk of quality deterioration and economic loss.

The interpretation of these findings suggests that the primary challenge facing millennial greenhouse farmers is not merely a lack of digital technology, but rather a limitation in transforming that technology into a productive marketing tool. While farmers have access to digital devices, they still require the skills to utilize these media strategically. This finding aligns with the argument put forward by Klerkx et al. (2019) in a Scopus-indexed study, which emphasized that digital transformation in agriculture requires not only technological infrastructure but also human resource capacity building, particularly in digital literacy and entrepreneurial skills. The findings also corroborate the research by Suryani et al. (2022), which demonstrated that digital marketing can increase market reach and enhance the economic value of agricultural products, provided it is supported by improved business operator competence. These converging findings underscore the importance of designing training interventions that address both the technical and strategic dimensions of digital marketing (Sabir et al., 2021; Suryani et al., 2022; Suswadi et al., 2023) .

A specific finding of this research is that the training needs of millennial greenhouse farmers are primarily focused on competencies that can be immediately applied to marketing activities. Key participant needs include using social media for business, creating promotional content, product photography, writing captions and copy, product branding, utilizing online marketplaces, and formulating digital marketing strategies. Participants also require an understanding of how to identify target consumers and communicate with potential buyers via digital channels. Another significant finding is the need for a marketing approach that can be implemented collaboratively by the farming community, as individual marketing efforts are often limited by constraints regarding time, media management capabilities, content consistency, and customer service capacity. These findings are consistent with the research by Fharaz et al. (2022), which identified digital literacy and age as significant factors influencing the e-marketing literacy of millennial farmers.

Based on these needs, the Project-Based Participatory Training (PBPT) model was developed as a digital marketing training approach for millennial greenhouse farmers. PBPT integrates project-based learning with a participatory approach. This model positions participants as active subjects in the training process; rather than merely receiving material from the facilitator, participants are involved in identifying marketing issues, determining needs, designing projects, engaging in practical activities, evaluating results, and formulating

follow-up plans. The implementation of PBPT in this study comprises seven stages, as presented in Table 2.

Table 2. PBPT Development Stages

Stage	Activity	Output
1	Problem and needs identification	Mapping of participants' issues and needs
2	Project Planning	Digital marketing project plan
3	Instruction and Practice	Digital marketing understanding and skills
4	Project Implementation	Digital marketing content and media
5	Mentoring	Refinement of project outcomes
6	Evaluation	Identification of changes in competence
7	Follow-Up	Digital Marketing Action Plan

Source: Developed by the researchers based on the Project-Based Participatory Training (PBPT) model, 2026.

These stages are designed to ensure that the learning process is contextual and relevant to the participants' real-world conditions. Agricultural products owned by the participants serve as direct objects during practical activities, enabling them to relate the training material to their own business conditions. The project-based learning approach offers participants the opportunity to gain experience by solving real-world problems. Kokotsaki, Menzies, and Wiggins (2016) explain that project-based learning fosters participant engagement through processes of investigation, collaboration, and project completion. Meanwhile, the participatory approach provides space for participants to be involved in planning and decision-making processes. Cornwall (2008) explains that community participation can encourage active engagement and enhance the sense of ownership regarding a program (Cornwall, 2008) . The integration of these two approaches forms the basis for developing the PBPT model in this study.

The training was conducted using a combination of material presentation, demonstrations, discussions, hands-on practice, group work, and mentoring. This approach ensured that participants not only understood the material theoretically but were also able to apply it to the agricultural products they produce. The initial session covered the fundamentals of digital marketing and shifts in consumer behavior during the digital era. Participants learned about the role of digital media in expanding market reach and the importance of establishing direct communication with consumers. The subsequent session focused on utilizing social media for marketing; participants were guided in developing accounts suitable for business use, covering everything from selecting an account name and setting up a business profile to managing product information and determining the types of content to publish. A session on branding was included to help participants understand the significance of product identity. Participants were guided to define their product names, unique selling points, visual characteristics, and the messages they wished to convey to consumers. Effective branding is expected to enhance product appeal and differentiate the farmers' products from similar offerings. Finally, participants were introduced to the use of online marketplaces and digital catalogs. They practiced compiling product details, pricing,

photographs, descriptions, and ordering information. Through these activities, participants gained a comprehensive understanding of the digital marketing process.

Participant competence is evaluated based on practical performance and the quality of the digital marketing projects produced during the training. Assessment criteria include engagement during practical sessions, the ability to apply the material, and the quality of the resulting digital marketing projects. Furthermore, participants have come to understand that digital marketing involves more than just uploading product photos; it requires planning regarding target consumers, content types, publication timing, the crafting of marketing messages, and consumer communication strategies. Project outputs such as promotional content, digital catalogs, product photos and videos, and branding designs demonstrate the participants' ability to apply the training material to their own agricultural products. These findings indicate that the PBPT model has been effective in facilitating the acquisition of practical digital marketing competencies among millennial greenhouse farmers.

As a follow-up to the training, participants develop a Digital Marketing Action Plan to serve as a guide for marketing implementation after the training concludes. This action plan is created through a participatory process, taking into account the product, target consumers, marketing channels, production schedule, and community capacity. The action plan comprises several key components, as presented in Table 3.

Table 3. Digital Marketing Action Plan Components

Components	Plan
Featured Product	Greenhouse-grown vegetables and horticultural commodities, such as lettuce, bok choy, or the primary crops produced by the farmers
Target Consumers	Households, young consumers, healthy food communities, restaurants, cafes, catering services, and local horticultural product resellers
Marketing Channels	Instagram, WhatsApp Business, TikTok, marketplace.
Content Types	Product photos and videos, greenhouse cultivation processes, product benefits, prices and promotions, customer testimonials, agricultural education, and information on product availability and ordering
Publication Frequency	3 posts per week and product information updates based on harvest availability
Promotion Strategy	Bulk purchase promos, product bundles, harvest pre-orders, periodic product updates, customer testimonials, and collaborations with MSMEs, restaurants, and local communities
Media Management	Media management is handled collaboratively by the farmer community, with tasks divided among members for content creation, uploading, customer service, and order recording
Order Recording System	Orders are recorded via WhatsApp Business or digital forms and compiled in a spreadsheet tracking customer name, product, order quantity, price, delivery time, and payment status
Marketing Evaluation	Evaluations are conducted monthly based on the number of posts published, social media reach/engagement, volume of inquiries and orders, number of new customers, sales figures, and any marketing challenges encountered

Source: Developed by the researchers based on the training outcomes and participatory planning process, 2026.

Research findings indicate that the primary challenge facing millennial greenhouse farmers in Panambangan Village is not merely a lack of digital technology, but rather a limitation in transforming that technology into a productive marketing tool. While farmers have access to digital devices, they still require the skills to utilize these media strategically. The development of the PBPT model offers an approach well-suited to this situation, as the training process is grounded in real-world challenges and results in projects directly relevant to the participants' businesses. Participants do not simply learn digital marketing concepts; they actively practice creating content, branding, catalogs, and marketing materials. This finding is consistent with the research by Bell (2010), which emphasized that project-based learning is effective in fostering 21st-century skills such as critical thinking, collaboration, and real-world problem-solving (Guo et al., 2020; Klerkx et al., 2019; Rijswijk et al., 2021) .

A participatory approach is also a crucial component of the PBPT model. Participants are involved in identifying needs, selecting products for the market, choosing appropriate media, and formulating marketing strategies. This involvement fosters a sense of ownership over the program and encourages the sustainability of activities after the training concludes. From a marketing perspective, the use of digital media offers an alternative to conventional marketing patterns (Deichmann et al., 2016; Fabregas et al., 2019) . Farmers gain the opportunity to communicate directly with consumers, showcase their products to a wider audience, and build customer relationships. This is particularly important for horticultural products, which are perishable and require relatively rapid marketing processes. These findings corroborate the research by Bennett et al. (2020), which highlighted the importance of participatory approaches in rural digital innovation and their contribution to sustainable agribusiness development (GmbH, 2019) .

However, the implementation of digital marketing cannot stop at the training phase. Sustainability requires consistency in content creation, routine platform management, responsiveness to consumers, product availability, and a clear division of tasks within the community. Consequently, a Digital Marketing Action Plan serves as a vital element of the developed model. Overall, the development of the PBPT model makes three key contributions. First, it enhances farmers' practical skills in using digital media for collective marketing through the Digital Marketing Action Plan. Second, it generates marketing media and content that are ready for immediate use. Third, it establishes a foundation for collective marketing management via the Digital Marketing Action Plan. Thus, the PBPT model offers a relevant training alternative for millennial greenhouse farmers as they navigate shifting marketing patterns in the Industry 4.0 era. The model focuses not only on knowledge transfer but also on skill development, practical experience, the creation of digital assets, and the formulation of community-based, sustainable marketing plans.

Comparing these findings with previous research from Google Scholar and Scopus databases, it is evident that the PBPT model offers a novel approach to addressing the digital competency gap among farmers. While previous studies have focused on the adoption of digital technology by farmers (Klerkx et al., 2019), the effectiveness of digital marketing in increasing sales (Suryani et al., 2022; Putri & Prasetyo, 2023), and the role of participatory approaches in rural development (Cornwall, 2008; Bennett et al., 2020), few studies have integrated these elements into a comprehensive training model for millennial greenhouse farmers. The PBPT model developed in this research fills this gap by combining project-based

learning with participatory methods, ensuring that the training is contextual, practical, and sustainable. This integration represents a significant contribution to the existing body of knowledge on community-based training models for agricultural development.

The findings of this research are consistent with the theoretical framework of project-based learning and participatory approaches. Bell (2010) states that project-based learning is effective in fostering 21st-century skills such as critical thinking, collaboration, and real-world problem-solving. The implementation of the PBPT model in this research demonstrates that participants who are actively involved in identifying marketing issues, designing projects, and producing digital marketing materials are able to develop practical competencies that are directly applicable to their business activities. Furthermore, Cornwall (2008) emphasizes that community participation can encourage active engagement and enhance the sense of ownership regarding a program. The participatory approach in the PBPT model has been shown to foster a sense of ownership among participants, as evidenced by their active involvement in decision-making processes and the formulation of the Digital Marketing Action Plan. These theoretical alignments confirm the robustness of the PBPT model as a framework for community-based digital marketing training.

The practical implications of this research are significant for various stakeholders. For farmers, the PBPT model provides a structured and practical approach to enhancing digital marketing competencies, which can lead to expanded market access, reduced post-harvest losses, and increased income. For agricultural extension services and community development practitioners, the model offers a replicable framework for designing and implementing digital marketing training programs for farmer communities. For policymakers, the findings highlight the need for policies that support digital infrastructure development, digital literacy training, and market access for smallholder farmers. For researchers, the study contributes to the body of knowledge on community-based training models and provides a basis for further research on digital marketing adoption in agriculture. These implications underscore the relevance and timeliness of the PBPT model in addressing the digital competency gap among millennial farmers.

Furthermore, the Digital Marketing Action Plan developed in this research serves as a practical tool for farming communities to manage their marketing activities collectively. By following this action plan, farming communities can ensure that their digital marketing efforts are conducted in a more focused and sustainable manner. The action plan also facilitates the division of tasks among community members, ensuring that content creation, platform management, customer service, and order recording are carried out consistently. This collaborative approach is particularly important for smallholder farmers who often face resource constraints and limited individual capacity. The action plan thus represents a mechanism for collective empowerment, enabling farmers to leverage their combined resources and capabilities to achieve better marketing outcomes.

In conclusion, the development of the Project-Based Participatory Training (PBPT) model offers a viable alternative training approach that is both contextual and practical for millennial greenhouse farmers. This model has the potential to facilitate expanded market access, enhance the competitiveness of horticultural products, mitigate the risk of unsold harvests, and strengthen the farming community's self-reliance in utilizing digital technology. The findings of this research contribute to the body of knowledge on community-based

training models and provide practical implications for farmers, extension services, policymakers, and researchers. The PBPT model, with its emphasis on hands-on practice, participatory involvement, and tangible outputs, represents a significant advancement in the design of training interventions for digital marketing in the agricultural sector. Future research should focus on evaluating the long-term sustainability and impact of the PBPT model, expanding its application to other farmer communities, and integrating quantitative methods to measure its effectiveness in diverse contexts.

CONCLUSION

The findings on the development of community-based digital marketing training using the Project-Based Participatory Training (PBPT) approach indicated that, although millennial greenhouse farmers in Panambangan Village had access to digital technology, their use of digital tools for marketing activities remained limited and required further improvement. The primary training needs included skills in promotional content creation, product photography, copywriting, branding, social media and online marketplace utilization, and digital marketing strategy development. The findings demonstrated that the training not only enhanced participants' knowledge of digital marketing but also provided practical experience in producing marketing materials to support the promotion of greenhouse products. The Digital Marketing Action Plan emerged as an important output for supporting program sustainability. It provided guidance for identifying target consumers, selecting appropriate marketing channels, planning content and publication schedules, developing promotional strategies, assigning responsibilities, and evaluating marketing activities. Through this structured plan, digital marketing activities could be conducted in a more focused, systematic, and sustainable manner. Overall, the PBPT approach provided a contextual and practical training model for millennial greenhouse farmers. The model showed potential to expand market access, strengthen the competitiveness of horticultural products, reduce the risk of unsold harvests, and enhance farmers' self-reliance in using digital technologies. These findings contribute to the literature on community-based training models and offer practical implications for farmers, agricultural extension services, policymakers, and researchers.

Based on these findings, future research should examine the long-term sustainability and impact of the Digital Marketing Action Plan on farmers' income, market access, and business performance through longitudinal designs. The PBPT model should also be tested in farmer communities involving different commodities and geographical contexts to assess its transferability and broader applicability. Future studies could incorporate quantitative or mixed-methods designs, including pretest-posttest assessments and comparison groups, to evaluate the effectiveness of the training model more rigorously. Additional research is also needed to examine the role of digital infrastructure, institutional support, and public policy in facilitating farmers' adoption of digital marketing. The integration of e-commerce platforms, digital payment systems, and other financial technologies should also be explored as part of a broader digital agricultural marketing ecosystem. Finally, future research should investigate the social and demographic factors associated with digital marketing adoption, including age, educational background, gender, digital literacy, and access to digital infrastructure. These research directions may support the development of more comprehensive, adaptable, and effective digital marketing training models for farming communities.

REFERENCES

Afridhianika, L., & Yudhianto, M. R. (2025). Digitalisasi agribisnis dan dampaknya terhadap jaringan pasar pedesaan. *Jurnal Inovasi Pertanian*, *14*(1), 22–31.

Arvianti, A., Putri, N., & Wibowo, R. (2022). Pemanfaatan platform digital oleh petani milenial dalam pemasaran hortikultura. *Jurnal Sosial Ekonomi Pertanian*, *11*(2), 45–58.

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *83*(2), 39–43. https://doi.org/10.1080/00098650903505415

Bennett, R., Yanuarti, T., & Nugroho, P. (2020). Participatory approaches in rural digital innovation: Pathways to sustainable agribusiness. *Journal of Rural Studies*, *79*, 166–174. https://doi.org/10.1016/j.jrurstud.2020.08.002

Cahya, F., Lestari, T., & Rahardjo, B. (2024). Pelatihan social media marketing bagi UKM petani bunga Desa Sidomulyo Kota Batu. *Jurnal Pengabdian Kepada Masyarakat*, *10*(1), 33–40.

Cornwall, A. (2008). Unpacking "Participation": Models, meanings and practices. *Community Development Journal*, *43*(3), 269–283.

Deichmann, U., Goyal, A., & Mishra, D. (2016). Will digital technologies transform agriculture in developing countries? *Agricultural Economics*, *47*(S1), 21–33. https://doi.org/10.1111/agec.12300

Fabregas, R., Kremer, M., & Schilbach, F. (2019). Realizing the potential of digital development: The case of agricultural advice. *Science*, *366*(6471), eaay3038. https://doi.org/10.1126/science.aay3038

Fharaz, A., Sutisna, A., & Marlina, N. (2022). Pengaruh literasi digital dan usia terhadap literasi e-marketing petani milenial. *Jurnal Komunikasi Pembangunan*, *8*(3), 105–117.

GmbH, D. G. für I. Z. (GIZ). (2019). *Ghana: Agribusinesss & innovation*. GIZ.

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, *102*, 101586. https://doi.org/10.1016/j.ijer.2020.101586

Indonesia, K. P. R. (2023). *Strategi Transformasi Digital Sektor Pertanian Indonesia*. Kementerian Pertanian RI.

Klerkx, L., Jakku, E., & Labarthe, P. (2019). A review of social science on digital agriculture, smart farming and agriculture 4.0: New contributions and a future research agenda. *NJAS - Wageningen Journal of Life Sciences*, *90–91*, 100315. https://doi.org/10.1016/j.njas.2019.100315

Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. *Improving Schools*, *19*(3), 267–277. https://doi.org/10.1177/1365480216659733

Laelago Ersedo, T., Teka, T. A., Fikreyesus Forsido, S., Dessalegn, E., Adebo, J. A., Tamiru, M., & Astatkie, T. (2023). Food flavor enhancement, preservation, and bio-functionality of ginger (Zingiber officinale): a review. In *International Journal of Food Properties* (Vol. 26, Number 1). https://doi.org/10.1080/10942912.2023.2194576

Nations, F. and A. O. of the U. (2021). *Smart farmers: Learning with digital technologies*. FAO.

Organization, F. and A. (2022). *The State of Food and Agriculture 2022: Leveraging automation in agriculture for transforming agrifood systems*. FAO.

Rijswijk, K., Klerkx, L., Bacco, M., Bartolini, F., Bulten, E., Debruyne, L., Dessein, J., Scotti, I., & Brunori, G. (2021). Digital transformation of agriculture and rural areas: A socio-cyber-physical system framework to support responsibilisation. *Journal of Rural Studies*, *85*, 79–90. https://doi.org/10.1016/j.jrurstud.2021.05.003

Sabir, M., Setiawan, R., & Handoko, A. (2021). *Manajemen greenhouse: Teknik, manajerial, dan pemasaran*. AgroMedia Press.

Suryani, D., Nugroho, A., & Hidayat, T. (2022). Pemanfaatan digital marketing dalam meningkatkan daya saing produk pertanian berbasis komunitas. *Jurnal Penyuluhan*, *18*(2), 198–210.

Suswadi, M., Yusuf, A., & Lestari, M. (2023). Pelatihan digital marketing untuk meningkatkan pengetahuan dan keterampilan pemuda tani komoditas hortikultura. *Jurnal Inovasi Pengabdian*, *7*(2), 78–85.