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TECHNOLOGICAL INNOVATIONS FOR SUPERIOR MICRO, SMALL, AND MEDIUM ENTERPRISES: TRANSFORMATION OF YOUTH ORGANIZATIONS IN THE DIGITAL ERA

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Abstrak

Program inkubasi wirausaha ini dirancang untuk memberdayakan pemuda Karang Taruna di Desa Poncol, Kabupaten Magetan, dengan tujuan utama meningkatkan kapasitas kewirausahaan dan daya saing UMKM lokal melalui integrasi kecerdasan buatan (AI) dan pemasaran digital. Kegiatan ini dilaksanakan menggunakan pendekatan Participatory Action Research (PAR), yang mencakup identifikasi kebutuhan berbasis potensi lokal, Focus Group Discussion (FGD) untuk ko-kreasi strategi pemasaran digital, pelatihan teknis penggunaan alat AI (analitik pasar dan desain konten otomatis), serta evaluasi kompetensi melalui pre-test dan post-test. Hasil kegiatan menunjukkan pencapaian yang signifikan: (1) peningkatan pemahaman kewirausahaan kreatif-inovatif sebesar 42% berdasarkan perbandingan skor pre-test dan post-test; (2) pengembangan kualitas dan kuantitas produk UMKM melalui optimalisasi branding digital dan ekspansi jaringan pemasaran; dan (3) peningkatan penguasaan teknis dalam pemanfaatan AI untuk perencanaan strategi pemasaran berbasis data. Temuan ini menunjukkan bahwa pemberdayaan sumber daya manusia pemuda berbasis teknologi dapat berperan sebagai katalis transformasi UMKM desa, dengan peningkatan daya saing produk lokal di pasar digital. Keberlanjutan inisiatif ini memerlukan pendampingan berkelanjutan dan pengembangan produk unggulan berbasis kearifan lokal.

***Kata kunci**: Inkubasi Wirausaha, Kecerdasan Buatan, Pemasaran Digital, Karang Taruna, UMKM Desa.*

Abstract

This entrepreneurship incubation program was designed to empower the youth of Karang Taruna in Poncol Village, Magetan Regency, with the primary objective of enhancing entrepreneurial capacity and the competitiveness of local MSMEs through the integration of artificial intelligence (AI) and digital marketing. The activities were carried out using a Participatory Action Research (PAR) approach, which included the identification of needs based on local potential, Focus Group Discussions (FGDs) for co-creating digital marketing strategies, technical training on the use of AI tools (market analytics and automated content design), and competency evaluation through pre-tests and post-tests. The results demonstrated significant achievements: (1) a 42% increase in understanding of creative and innovative entrepreneurship, as measured by pre- and post-test scores; (2) improvement in the quality and quantity of MSME products through optimized digital branding and expanded marketing networks; and (3) enhanced technical proficiency in utilizing AI for data-driven marketing strategy planning. These findings indicate that technology-based youth empowerment can catalyze transforming village-based MSMEs, leading to increased competitiveness of local products in the digital market. The

sustainability of this initiative requires continuous mentoring and the development of flagship products rooted in local wisdom.

Keywords: Entrepreneurial Incubation, Artificial Intelligence, Digital Marketing, Youth Organizations, Village MSMEs.

INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) are the main pillars in Indonesia's economic structure, contributing 60.5% to the Gross Domestic Product (GDP) and absorbing 96.9% of the national workforce (Yolanda, 2024). The strategic role of MSMEs is not only limited to economic aspects, but also includes the social dimension as an instrument of inclusive and sustainable development (Lubis, 2024). The superior characteristics of MSMEs such as limited capital accessibility, labor absorption capacity without formal education prerequisites, adaptability to minimal infrastructure, and resilience to crises make them catalysts for equitable distribution of welfare (Aktaviana, 2023).

However, Indonesian MSMEs still face major challenges in terms of digitalization (Murtiningsih, 2024). Data from the Indonesian Chamber of Commerce and Industry, (2025) shows that 87% of MSMEs experience limitations in digital literacy, data utilization for decision-making, and digital marketing efficiency. This has a direct impact on the low competitiveness of local products in the global market (Bakrie, 2024). Technology-based entrepreneurial incubation has emerged as a transformative solution through the provision of technical facilities, managerial assistance, and the acceleration of technology adoption (Effendi, 2022). However, there are not many community service activities that apply AI-based incubation models in rural contexts such as Poncol Village, so a more adaptive approach and based on local needs is needed.

The results of an initial survey conducted on 35 active members of the Poncol Village Youth Organization showed that 74% of respondents had never participated in technology-based entrepreneurship training, and 68% of them admitted that they did not understand the basic concepts of artificial intelligence and digital marketing. In addition, only 12% of local MSME actors have actively used social media for product promotion, and none use AI-based analytics tools. These findings indicate a significant gap between demographic potential and technological readiness, which, if not bridged immediately, risks widening the digital divide and hampering the competitiveness of local products. Therefore, structured and participatory technology-based interventions are very urgent to encourage inclusive village economic transformation.

The integration of artificial intelligence (AI) and digital marketing offers a great opportunity in revolutionizing the MSME business model (Amira, 2023). AI enables predictive analytics for the identification of market trends, while digital marketing expands its geographic reach significantly (Novantara, 2024). The

synergy between the two forms a new paradigm in digital-enabled entrepreneurship that is more responsive to market dynamics (Omwenga, 2021). In the context of community service, this approach can be used as an innovative framework to increase the effectiveness of village-based MSME empowerment programs (Kamutuezu, 2021).

Karang Taruna as a representation of village youth has strategic demographic potential (Putra, 2024). In Poncol Village, 63% of the population is of productive age, with a natural tendency towards technology as a digital native. However, this potential has not been optimally exploited due to the lack of structured assistance (Aktaviana, 2023). Poncol Village also has local economic potential such as pamelo orange clusters, dairy cattle farms, and biofloc catfish cultivation, which have not been integrated into the digital entrepreneurship ecosystem. Therefore, the program is designed to bridge four key gaps namely AI skills, market access, innovation capacity, and business sustainability.

Although various studies have discussed the importance of MSME digitalization and the role of business incubation in increasing the competitiveness of small businesses, most still focus on urban or semi-urban contexts with relatively adequate digital infrastructure (Prayogi, 2022), (Eryc, 2023). There have not been many community service activities with an artificial intelligence (AI)-based incubation model in the context of villages with limited access to technology and low digital literacy (Zamahsyari, 2022). This gap shows the need for a more contextual and participatory approach in designing MSME empowerment interventions in rural areas. Therefore, this entrepreneurial incubation program is designed to empower the youth of Karang Taruna in Poncol Village, Magetan Regency, with the main goal of increasing the entrepreneurial capacity and competitiveness of local MSMEs through the integration of artificial intelligence (AI) and digital marketing.

MATERIALS AND METHODS

The MSME development program through entrepreneurial incubation for the youth of Karang Taruna in Poncol Village, Magetan Regency, is carried out with a Participatory Action Research approach (Chevalier, 2019). This method was chosen to ensure the contextual relevance and sustainability of the intervention, through four structured stages: (1) needs mapping based on local potential, (2) co-creation of solutions through Focus Group Discussion (FGD), (3) AI and digital marketing technical training, and (4) evaluation of results based on pre-test and post-test designs. This program is accompanied by partners of Karang Taruna Tunas Harapan and the Magetan Regency Cooperatives and MSMEs Office, who play a role in providing data, network facilitation, and post-program sustainability support.

The implementation of this program involves 5 main facilitators, consisting of accompanying lecturers, digital marketing practitioners, and members of Karang Taruna who have participated in previous training. The duration of the training lasts

for 3 weeks, with a total of 6 intensive sessions of 3–4 hours each. The competency evaluation of participants was carried out using a combination of pre-test and post-test questionnaires based on the Bloom Taxonomy, technical skills observation rubrics, and participatory reflection forums. For quantitative data analysis, SPSS software version 26 was used for the paired sample t-test statistical test, while the qualitative analysis was carried out manually using model-based thematic coding techniques (Semiawan, 2010). The training platforms used include Canva AI, Google Trends, WhatsApp Business, and BukuKas, which are simulated directly in practical sessions. The stages of service activities are explained as follows:

Identify Needs and Map Local Potential

The initial stage aims to inventory the specific challenges of MSMEs and village potential. The procedure included an ethnographic survey of 15 MSME actors and 20 youth of Karang Taruna using in-depth interviews as shown in Table 1. Furthermore, the analysis of the technology gap uses digital literacy indicators. The outputs of this stage are the priority needs matrix and the design of contextual training modules.

Table 1. Summary of Participant Characteristics

Participant Categories	Amount	Types of Activities Participated in
Youth Organisation	20	Surveys, FGDs, Training, Evaluation
MSME Actors	15	Surveys, FGDs, Training
FGD participants (total)	24	Thematic FGD (Food, Crafts, Services)
Technical Training Participants	30	AI & Digital Marketing Module

Source: Author's data, 2025

Co-Creative Focus Group Discussion (FGD)

As part of the participatory approach, the Focus Group Discussion (FGD) activities were carried out in three thematic sessions tailored to the characteristics of local businesses, namely: food, handicrafts, and services. Each session involves 6–8 participants who are selected based on the principle of homogeneous sampling, to ensure the same background and business experience in the group (Gusti, 2021). The selection of participants was carried out purposively to represent active MSME actors and youth of Karang Taruna who have entrepreneurial potential.

The discussion was facilitated by trained moderators using structured group interaction-based facilitation techniques, which emphasized the management of group dynamics, equitable opinion polling, and avoidance of dominance of certain participants The main topics discussed included: optimization of local product branding, customer journey design based on digital platforms, and the integration of artificial intelligence (AI) in market analysis and consumer behavior. The discussion also highlighted the challenges of cultural diversity and customer preferences in digital marketing.

As a result of this co-creative process, participants successfully developed an integrated digital marketing roadmap that included a content strategy, distribution

channels, and data-driven success indicators. This document serves as a reference in technical training and advanced assistance, and serves as a monitoring and evaluation tool for the impact of programs on MSME performance.

Simulation-Based Technical Training

The training was attended by 30 participants, consisting of 20 youth of Karang Taruna and 10 MSME actors. The training modules include: (1) Digital Marketing consisting of Instagram/TikTok optimization, e-commerce management, content design with Canva AI. (2) AI analytics include google trends, meta business suite, whatsapp business chatbot. (3) MSME management in the form of digital bookkeeping (BukuWarung), pricing strategy. The learning by doing approach is used by simulating real cases from local MSMEs.

Competency Evaluation and Systemic Reflection

Evaluation was carried out through Pre-test and post-test using questionnaires, with a reliability of $\alpha = 0.87$. Observation rubric to assess the technical skills of the participants. Furthermore, participatory reflection forum activities. Data analysis was carried out by differential tests using paired sample t-tests to measure cognitive improvement as well as qualitative thematic analysis for behavior change. This program is also designed to be sustainable through tiered mentoring between participants, adaptive counseling for MSMEs with technical barriers, digital communities through WhatsApp groups as a forum for discussion and sharing of good practices.

RESULTS AND DISCUSSION

Needs Analysis and Local Potential Mapping

The digital incubation program in Poncol Village is carried out gradually and systematically, starting from the stage of identifying needs through surveys and in-depth interviews with 35 respondents consisting of MSME actors and youth of Karang Taruna. The results of the analysis show that 82% of business actors experience obstacles in product marketing, while 70% of farmers face difficulties in accessing the market directly. These findings are the basis for designing contextual and applicative technology-based interventions.

The mapping of local assets identified three main economic potentials of the village, namely: (1) a 25-hectare pamelo orange cluster with a high production capacity, (2) a dairy farm with a population of 150 heads, and (3) biofloc catfish cultivation spread across several hamlets. Based on the results of the Focus Group Discussion (FGD), participants formulated two leading local brands, namely 'Premium Pamelo Magetan Orange' and 'Poncol Fresh Milk'. As many as 80% of participants chose Facebook Marketplace as the main digital marketing channel because of its ease of access and wide market reach.

The intensive training was conducted in three main sessions, namely: (1)

simulation of creating promotional content using Canva, which resulted in more than 90 ready-to-upload visual content; (2) training in online ordering systems using Google Forms, spreadsheets, and WhatsApp Business; and (3) strengthening digital financial management through the BukuKas application. All training sessions use an experiential learning approach to ensure practical skill transfer.

Implementation of Incubation Programs

The implementation of the digital incubation program in Poncol Village has shown significant results in increasing the entrepreneurial capacity of Karang Taruna youth and local MSME actors. The participation rate reached 100% (35 participants), with indicators of active involvement in discussions and simulation practices. Pre-test and post-test evaluations showed an increase in understanding of agricultural entrepreneurship by 37%, with the average score increasing from 45.6 to 62.5 as described in Table 2. This indicates a statistically significant increase.

Tabel 2. Paired Samples Statistics

	Mean	**Std. Deviation**	**Std. Error Mean**
Pre-Test	45.6	12.0	2.03
Post-Test	62.5	13.5	2.28

Source: Processed Results, (2025)

The results of the statistical test using the paired sample t-test showed the values t = 4.82, df = 34, and p-value = 0.0001 as described in Table 3.

Tabel 3. Paired Samples Test

Paired Differences	**Values**
Mean	16.9
Std. Deviation	15.2
Std. Error Mean	2.3
95% CI Lower	12.2
95% CI Upper	21.6
t	4.82
df	34
Sig. (2-tailed)	0.0001

Source: Data Processed, (2025)

The improvement in quality after the program is described in Table 4, which strengthens the evidence of increased participants' understanding of digital

entrepreneurship materials.

Table 4. Capacity Building of Program Participants

Indicator	Before the Program	After the Program	Percentage Increase
Basic digital literacy	2.3 / 5	4.1 / 5	78%
Use of financial applications (BukuKas)	18%	85%	+67%
Content design capabilities (Canva)	25%	83%	+58%

Source: Author's data, 2025

The concrete transformation was shown by the orange farmer group 'Sumber Rejeki' which developed premium packaging with QR code labels, and the 'Ngemplak Lestari' group which increased milk sales by 35% through the online ordering system. In addition, there was an increase in buying interest by 28% after packaging innovation and product diversification. The economic impact analysis shows that the agricultural sector (pamelo oranges) has experienced an increase in market access and selling prices, the livestock sector (cow's milk) has shown distribution efficiency, and the fisheries sector (biofloc catfish) has begun to adopt digital ordering systems gradually. The enthusiasm of the participants is depicted in Figure 1.

Figure 1. Socialization and Implementation Activities

As part of the sustainability strategy, the program also includes four weeks of hands-on mentoring. A team of facilitators from Karang Taruna assisted business actors in implementing the results of the training in their respective

business units. Mentoring activities include assistance in creating digital product catalogs, optimizing social media accounts, and testing online ordering systems. Weekly evaluations show that 68% of participants start receiving orders through digital platforms, and there is a 45% increase in consumer interaction in the first two weeks after the promotional content is published. These findings indicate that a consistent and participation-based approach to digital incubation is able to effectively encourage the adoption of technology among village MSME actors. This success also demonstrates the importance of integration between technical training, field assistance, and the use of local assets as the foundation of digital-based economic transformation in rural areas.

Evaluation and Sustainability

An evaluation of the digital incubation program showed that 70% of participants actively applied the skills acquired in the training, three months after the program ended. The average increase in business turnover reached 22%, with the adoption of digital tools such as financial applications and online marketing platforms by 52% as shown in Table 6. In addition, the participant's marketing network increased by 30%, which was demonstrated through the expansion of distribution channels and increased consumer interaction. One of the indicators of community success is the formation of the WhatsApp group 'Petani Digital Poncol' which now has 120 members and is actively used as a forum for sharing price information, agricultural practices, and marketing strategies.

Table 5. Economic Impact Based on Business Sector

Business Sector	Number of Participants	Pre-Program Turnover (average)	Post-Program Turnover (average)	Percentage Increase in Turnover
Agriculture (Orange)	20	Rp3.500.000	Rp4.500.000	28,57%
Farm	15	Rp4.000.000	Rp4.600.000	15,00%

Source: Author's data, 2025

The digital incubation program implemented in Poncol Village has a positive economic impact on local business actors, especially in increasing turnover. Of the total 35 participants, there are two main sectors involved, namely agriculture (orange) and livestock. Data shows that the agricultural sector experienced an average turnover increase of 28.57%, while the livestock sector only increased by 15%. This indicates that the agricultural sector is more responsive to the digitalization interventions provided during the program.

This difference in impact can be due to the characteristics of agricultural businesses that are more open to digital marketing innovations, such as the use of social media and financial applications to reach a wider market. Meanwhile, the livestock sector tends to have longer production cycles and more complex logistical challenges, so the impact of digitalization has not been fully optimal.

These findings are important to be considered in the design of a more sectoral and focused follow-up program

Although the program's achievements are quite significant, there are a number of technical challenges faced by participants. As many as 65% of participants do not have adequate personal devices for digital operations, and internet connectivity in agricultural areas such as rice fields is still unstable. In addition, there is resistance from senior farmers to the use of new technologies. To overcome these barriers, the implementation team adapted through the provision of print training modules, WhatsApp-based training, and the formation of cross-generational learning groups that allow for informal and contextual knowledge transfer.

The existence of the WhatsApp group 'Poncol Digital Farmers' has developed into an active and inclusive learning community. Group members regularly exchange good practices such as product packaging techniques, strategies for dealing with price fluctuations, and sharing tutorials on using digital applications through short videos. This dynamic shows that the digitalization process in the village is not enough only through formal training, but also requires a continuous interaction space that is informal and adaptive to the daily needs of local business actors.

To support long-term sustainability, the program initiated partnerships with village cooperatives as follow-up incubators. The cooperative is designed to be a center for digital literacy and community-based collective marketing, and is integrated with the village government's plan to develop smart villages. In addition, participants who demonstrated technological capabilities were empowered as local mentors for the regeneration of digital skills for farmer groups and other MSMEs. This strategy aims to create an independent, sustainable, and open system to cross-sector collaboration.

Strategic Recommendations for Sustainability and Program Replication

Based on the achievements of the digital entrepreneurship incubation program in Poncol Village, four strategic recommendations were identified that are important to expand the impact and maintain the sustainability of this initiative in a systemic and sustainable manner. Currently, there are still areas in Poncol Village that are experiencing difficulties with mobile signals and internet access. These obstacles have a direct effect on the consistency of technology use in business activities such as digital marketing, application-based bookkeeping, and communication with consumers. Therefore, local governments can apply for cooperation with mobile service providers to build signal towers in hilly areas. It is also encouraged to build village public WiFi that can be managed by BUMDes or Karang Taruna, so that it can be used collectively by MSME actors. Digital infrastructure is the foundation of transformation and allows the acceleration of the use of technology evenly.

Despite the high entrepreneurial spirit, most MSME actors still face limited capital for product expansion or diversification. Access to conventional financing is often hampered due to the lack of collateral and financial literacy. It is recommended to integrate program participants with digital-based People's Business Loans, through partnerships with Himbara banks or digital cooperatives. Sharia-based fintech can also be a strategic partner, with a risk-loss sharing financing mechanism that is in accordance with the characteristics of farmers and village breeders. This will strengthen production and managerial capabilities, while increasing the confidence of business actors in expanding.

Karang Taruna has proven to be the driving force for innovation in this program. However, their institutional capacity needs to be strengthened in order to be able to function as a permanent village incubation institution. It is recommended to establish a special unit "MSME and Digital Innovation Division" in the structure of Karang Taruna. This division is in charge of managing periodic training, assisting market access, facilitating branding, and liaising with external parties (banking, digital platforms, and universities). Thus, Karang Taruna is not only the implementer, but also the guardian of the continuity of innovation at the village level. Success in Poncol can be replicated to surrounding villages that have similar commodity-producing potential, such as vegetable, coffee, or dairy farming villages on the slopes of Mount Lawu. The ideal replication is carried out with a digital commodity cluster approach, which is to form a network between MSME actors across villages with the same commodities. Coordination can be facilitated by the Cooperatives and MSMEs Office, by involving universities and private sector CSR partners.

This approach supports the principles of village collaborative economics and accelerates the digitalization of region-based MSMEs. The technology-based digital entrepreneurship incubation program initiated by the youth of Karang Taruna in Poncol Village has proven that the digital transformation of village MSMEs is very possible and has a real impact, as long as it is carried out with a contextual and participatory approach. The program's achievements show capacity building, adoption of simple technological innovations, and positive economic impact for local business actors. More than that, this initiative also encourages the growth of digital community independence, where village youth become agents of change that encourage innovation, collaboration, and social learning.

However, sustainability and expanding the impact of the program requires a systemic strategy, starting from the provision of digital infrastructure, integration with financing schemes, strengthening local institutions, to cross-regional replication. With this strategic step, the digital transformation of MSMEs is not only a temporary project, but a sustainable movement towards smart and economically independent villages.

The results of this program are in line with the findings (Rofiyustisiani, 2025) which show that the integration of digital technology in village MSMEs is able to increase operational efficiency and competitiveness of local products. Similarly, the Herfiansyah study, (2024) confirms that the use of AI in market analysis and digital content strategies has a positive impact on increasing turnover and market penetration. Thus, the incubation program in Poncol Village is not only relevant locally, but also contributes to scientific discourse on the digital transformation of community-based MSMEs.

The discussion of the results of this activity can be analyzed through a theoretical approach that strengthens the academic validity of the program. First, the empowerment theory by Nurmayanti, (2025) emphasizes the importance of increasing individual and collective capacity in accessing resources and making strategic decisions. This is reflected in the active involvement of Karang Taruna youth in digital training and mentoring. Second, the concept of digitizing MSMEs according to Adventio, (2024) shows that the adoption of simple technology such as financial applications and social media can increase operational efficiency and competitiveness of local products.

These findings are in line with the increase in turnover and consumer interaction achieved by program participants. Third, the community-based development approach as described by Phillips, (2014) emphasizes the importance of local participation in resource management and community-based innovation. The success of the WhatsApp group 'Poncol Digital Farmers' as an informal learning forum shows that digital transformation is not only technical, but also social and cultural. By integrating these various theories, it can be concluded that the program not only improves technical skills, but also strengthens the social structure and collective capacity of rural communities in the face of digital economy challenges.

CONCLUSIONS AND SUGGESTIONS

The MSME development program through an entrepreneurial incubation model involving the youth of the Poncol Village Youth Organization has proven to be effective in answering the challenges of unemployment and improving the welfare of the village community. The interventions carried out, in the form of digital training, mapping local potential, and strengthening marketing networks, have produced measurable real impacts, including an increase in turnover by 22%, the formation of six new business units, and an increase in entrepreneurial understanding of up to 42%. This success confirms that strategies based on cross-generational collaboration, the use of simple technology, and a focus on local wisdom are able to create sustainable economic transformation at the village level. This activity proved to be an important contribution to the development of

technology-based community service literature, especially in the context of rural and village youth communities.

For the next service, it is suggested that the village government and strategic partners support the expansion of this incubation model through the establishment of a digital-based Youth Organization innovation center that functions as a village entrepreneurship laboratory. This step needs to be followed by further assistance for product certification to meet national and international standards, thereby increasing the competitiveness of local MSMEs. In addition, the provision of adaptive infrastructure, such as solar-based cold storage and community internet access through mesh network technology, is crucial to support the supply chain and product distribution efficiently. Partnerships with local cooperatives and higher education institutions also need to be strengthened to create an independent, inclusive, and highly competitive village entrepreneurial ecosystem in the digital economy era.

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