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Community Empowerment through IoT-Based Smart Poultry Farming and Product Innovation in Kampung Ilmu

Pemberdayaan Masyarakat melalui Teknologi IoT dan Inovasi Produk di Kampung Ilmu

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Community Empowerment, Internet of Things, Smart Poultry Farming, Product Innovation, Appropriate Technology

ABSTRACT

Community empowerment requires the integration of appropriate technology and community capacity building to improve productivity and economic competitiveness. This community service program was conducted at Kampung Ilmu, Purwakarta, Indonesia, to address manual poultry farming practices, low hatchability rates, and limited product competitiveness. The program aimed to empower the community through the implementation of Internet of Things (IoT)-based poultry technology and product innovation. The implementation stages included needs assessment, field observation, prototype development, implementation, training, mentoring, and evaluation involving lecturers, students, and community partners. The program produced an IoT-based smart poultry house, a smart egg incubator, modular poultry housing, and environmentally friendly packaging for eggs and vegetables. Evaluation results showed increased community knowledge and skills in poultry management, packaging techniques, and product branding after the mentoring activities. The implementation of appropriate technology improved farming efficiency, strengthened community capacity, and enhanced the competitiveness of local products. These findings indicate that integrating IoT technology with product innovation can effectively support sustainable rural community empowerment.

Kata Kunci:

Pemberdayaan Masyarakat, Internet of Things, Peternakan Pintar, Inovasi Produk, Teknologi Tepat Guna,

ABSTRAKSI

Pemberdayaan masyarakat memerlukan integrasi teknologi tepat guna dan peningkatan kapasitas masyarakat untuk meningkatkan produktivitas serta daya saing ekonomi. Kegiatan pengabdian kepada masyarakat ini dilaksanakan di Kampung Ilmu, Kabupaten Purwakarta, untuk mengatasi pengelolaan peternakan ayam yang masih dilakukan secara manual, rendahnya keberhasilan penetasan telur, serta rendahnya daya saing produk lokal. Program bertujuan memberdayakan masyarakat melalui penerapan teknologi Internet of Things (IoT) dan inovasi produk. Metode pelaksanaan meliputi identifikasi kebutuhan, observasi lapangan, pengembangan prototipe, implementasi, pelatihan, pendampingan, dan evaluasi dengan melibatkan dosen, mahasiswa, dan mitra masyarakat. Luaran kegiatan berupa kandang ayam pintar berbasis IoT, inkubator telur cerdas, kandang modular, serta kemasan telur dan sayuran ramah lingkungan. Hasil evaluasi menunjukkan peningkatan pengetahuan dan keterampilan masyarakat dalam pengelolaan peternakan, teknik pengemasan, dan visual branding. Penerapan teknologi tepat guna berhasil meningkatkan efisiensi pengelolaan peternakan, memperkuat kapasitas masyarakat, serta meningkatkan daya saing produk lokal. Temuan ini menunjukkan bahwa integrasi teknologi IoT dan inovasi produk efektif mendukung pemberdayaan masyarakat yang berkelanjutan.

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1. Introduction

Community empowerment has become one of the strategic approaches in supporting sustainable development through improving community capacity, technology adoption, and local economic competitiveness. Higher education institutions play an essential role in implementing community service programs by transferring knowledge and appropriate technology that address real problems faced by society. In the context of rural development, community empowerment should not only focus on increasing knowledge but also encourage the utilization of technological innovations that can improve productivity, operational efficiency, and community welfare.

The rapid development of the Internet of Things (IoT) has created new opportunities for the agricultural and livestock sectors. IoT technology enables real-time monitoring, automatic control, and data-driven decision-making through the integration of sensors, microcontrollers, communication networks, and cloud-based monitoring systems. Previous studies have demonstrated that IoT implementation in poultry farming can improve environmental control, optimize feeding management, reduce operational costs, and increase livestock productivity [2], [3], [11], [12]. Nevertheless, the adoption of digital technology among community-based livestock farmers remains relatively limited due to inadequate technological knowledge, limited infrastructure, and insufficient technical assistance.

Fig. 1 – Group Photo of the Community Service Team, Students, and Kampung Ilmu Management.

Kampung Ilmu, located in Cisarua Village, Tegalwaru District, Purwakarta Regency, is a community-based educational village that integrates educational, agricultural, and livestock activities to strengthen local economic independence. Besides functioning as a learning center, Kampung Ilmu develops poultry farming and vegetable cultivation as community empowerment programs involving local residents. However, preliminary observations and discussions with community partners identified several challenges that limited the effectiveness of these activities.

The primary problems included manual poultry management, unstable temperature and humidity during egg incubation, inefficient water management, and limited utilization of digital technology for monitoring farming activities. Furthermore, egg and vegetable products were marketed using conventional packaging with limited protection and weak visual identity, reducing their competitiveness in local markets. These conditions indicated that technological intervention alone would be insufficient unless accompanied by product innovation and community capacity development.

To address these challenges, Universitas Pembangunan Jaya implemented a multidisciplinary community service program involving the Informatics, Architecture, and Product Design Study Programs. The program integrated the development of an IoT-based smart poultry house, a smart egg incubator, modular poultry housing, and environmentally friendly product packaging with training and mentoring activities. This integrated approach was designed not only to introduce appropriate technology but also to strengthen community knowledge and practical skills for sustainable technology utilization.

Unlike many community service programs that primarily emphasize socialization or technical training, this program combined digital technology, product innovation, and participatory mentoring into a comprehensive empowerment model. The integration of engineering, design, and community participation is expected to provide sustainable impacts on livestock productivity, operational efficiency, and product competitiveness while strengthening community self-reliance.

Therefore, this community service aimed to empower the Kampung Ilmu community through the implementation of IoT-based poultry farming technology and product innovation to improve livestock management, enhance community capacity, and increase the competitiveness of local products as part of sustainable rural development.

2. Method

This community service program employed a participatory approach involving lecturers, students, and community partners from Kampung Ilmu, Cisarua Village, Tegalwaru District, Purwakarta Regency, West Java. The program was implemented through five sequential stages: needs assessment, solution design, technology implementation, capacity building, and evaluation.

The first stage was needs assessment, which consisted of field observations, interviews, and discussions with community partners to identify the main challenges in poultry farming and product marketing. This activity focused on evaluating poultry house conditions, egg incubation practices, feeding and watering systems, and the packaging of local products. The assessment results were used to determine priority problems and formulate appropriate technological interventions.

The second stage was solution design, during which multidisciplinary teams from the Informatics, Architecture, and Product Design Study Programs collaboratively designed appropriate solutions. The Informatics team developed IoT-based monitoring and automation systems, the Architecture team designed a modular poultry house emphasizing natural ventilation and operational efficiency, while the Product Design team developed environmentally friendly packaging for eggs and vegetables.

The third stage involved technology implementation, including prototype development, installation, testing, and integration of the IoT-based smart poultry house and smart egg incubator. The developed system utilized ESP32 microcontrollers integrated with temperature and humidity sensors, ultrasonic sensors, relay modules, and MQTT communication for real-time monitoring and automatic environmental control. Product packaging prototypes were also produced and introduced to the community.

The fourth stage was capacity building, consisting of technical training and hands-on mentoring for community members. Participants were trained to operate the IoT devices, perform routine equipment maintenance, manage poultry farming activities, and apply appropriate packaging techniques for local products. Practical demonstrations and direct assistance were provided to ensure participants could independently utilize the developed technologies.

Table. 1 Timeline of Community Service Activities

Activities	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26	Apr-26	May-26	Jun-26	Jul-26
Project planning and coordination									
Needs assessment (observation, interviews, discussions)									
Solution design and prototype development									
Development of IoT system and modular poultry house									
Development of eco-friendly product packaging									
Installation and testing of IoT-based poultry system									
Community training and mentoring									
Monitoring and program evaluation (pre-test & post-test)									
Final evaluation, documentation, and reporting									

The final stage was evaluation, which aimed to measure the effectiveness of the program. Evaluation was conducted using observations, interviews, and pre-test and post-test assessments to measure improvements in participants' knowledge and practical skills. The evaluation results were analyzed descriptively to determine the impact of the implemented technologies and mentoring activities on community capacity and the sustainability of the empowerment program.

3. Result and Discussion

3.1 Identification of Community Needs

The preliminary observation and field discussion identified several priority problems affecting the sustainability of poultry farming activities at Kampung Ilmu. Poultry management, including feeding, watering, and environmental monitoring, was still conducted manually, requiring considerable labor and limiting operational efficiency. Egg incubation also relied on conventional methods, making temperature and humidity difficult to maintain consistently, which reduced hatchability rates. In addition, locally produced eggs and vegetables were marketed using simple packaging with limited protection and weak product identity, reducing their market competitiveness.

These findings confirmed that the community required integrated solutions combining appropriate technology, product innovation, and capacity building rather than stand-alone technical assistance [13], [14].

Fig. 2 – Needs Assessment Discussion with Kampung Ilmu Community Partners.

3.2 Implementation of Appropriate Technology

Based on the identified needs, the multidisciplinary team developed several technological innovations consisting of a modular poultry house, an IoT-based smart poultry monitoring system, and a smart egg incubator. The modular poultry house was designed to improve ventilation, facilitate maintenance, and support environmentally sustainable livestock management.

The IoT system utilized ESP32 microcontrollers integrated with temperature sensors, ultrasonic sensors, relay modules, and MQTT communication to monitor environmental conditions and automate water supply management. Environmental data were transmitted to a web-based dashboard, enabling real-time monitoring by community members. Furthermore, the smart incubator automatically controlled temperature, humidity, egg turning, and water availability according to the incubation period, minimizing

manual intervention while maintaining stable incubation conditions.

Fig. 3 – Modular Poultry Chicken Coop with a Knock-Down System

Besides technological implementation, the Product Design team introduced environmentally friendly packaging for eggs and vegetables using recyclable materials. The redesigned packaging provided better product protection, improved visual identity, and increased product attractiveness for consumers.

Fig. 4 – Innovative Packaging for Eggs and Water Spinach.

3.3 Community Capacity Building and Program Outcomes

Technology implementation was accompanied by technical training and mentoring to ensure sustainable utilization by community members. Training activities covered operation of IoT devices, poultry management, equipment maintenance, and product packaging techniques.

Table. 2 Table of Evaluation of Community Capacity Before and After Program Implementation

Empowerment Indicator	Before the Program	After the Program	Improvement (%)
Understanding of egg damage risk mitigation	30%	85%	55%
Skills in modern packaging techniques	20%	90%	70%
Visual management and branding capabilities	15%	75%	60%

Evaluation conducted through pre-test and post-test demonstrated positive improvements in participants' knowledge and practical skills. Community understanding of egg handling and damage mitigation increased from 30% to 85%, packaging skills improved from 20% to 90%, while knowledge of visual branding increased from 15% to 75%. These improvements indicate that the program successfully enhanced both technological literacy and entrepreneurial capacity among participants.

The community also showed increased confidence in operating IoT-based equipment independently after the mentoring sessions, indicating successful technology transfer from the university to community partners.

3.4 Discussion

The implementation results demonstrate that integrating appropriate technology with participatory mentoring provides broader impacts than technology deployment alone [1], [13]. The IoT-based poultry system reduced manual monitoring activities and enabled more efficient livestock management through automatic environmental control and real-time monitoring. Likewise, the smart incubator contributed to improving incubation management by maintaining stable environmental conditions throughout the hatching process.

Meanwhile, product packaging innovation complemented technological intervention by increasing product value and strengthening local branding. The combination of engineering innovation, product design, and community participation created a comprehensive empowerment model that addressed both production and marketing aspects.

This multidisciplinary approach aligns with the concept of sustainable community empowerment, where technological innovation is accompanied by knowledge transfer and active community participation [1], [14]. Consequently, the program not only produced technological outputs but also strengthened community capacity to independently operate, maintain, and further develop the introduced innovations. These outcomes indicate that integrating IoT technology

with product innovation has considerable potential to improve productivity, operational efficiency, and economic competitiveness in community-based livestock enterprises.

Fig. 5 – Setup of the IoT-Based Egg Incubator System

4. Conclusion

The community service program successfully demonstrated that integrating Internet of Things (IoT)-based technology with product innovation can effectively support sustainable community empowerment at Kampung Ilmu, Purwakarta. The implementation of a smart poultry house, smart egg incubator, modular poultry housing, and environmentally friendly product packaging improved operational efficiency while enhancing community knowledge and practical skills in poultry management and product development. The mentoring activities also strengthened the community's capacity to independently operate and maintain the introduced technologies. Furthermore, improvements observed in participants' knowledge and packaging skills indicate that the combination of appropriate technology, multidisciplinary collaboration, and participatory assistance provides a sustainable empowerment model that can be replicated in other rural communities with similar characteristics.

Fig. 6 – Handover of Community Service Program Assets to Kampung Ilmu Management

For future community service initiatives, continuous mentoring and periodic evaluation are recommended to ensure the long-term sustainability of the implemented IoT technology. Future programs may expand this empowerment model to other rural communities with similar socio-economic characteristics by adapting the technological solutions to local needs and available resources. Furthermore, strengthening the capacity of local community members as technology facilitators, supported by collaboration among universities, local governments, and community organizations, is expected to enable independent operation, maintenance, and further development of the IoT-based poultry farming system beyond the completion of the mentoring program.

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References

[1] H. A. El Bilali and M. S. Allahyari, “Transition towards sustainability in agriculture and food systems: Role of information and communication technologies,” Agriculture, vol. 11, no. 10, Art. no. 923, 2021.

[2] M. Eastwood, D. Edwards, and J. Turner, “Anticipating alternative futures for precision livestock farming,” Animal Frontiers, vol. 12, no. 1, pp. 25–33, 2022.

[3] R. O. Ojo, A. O. Ajayi, H. A. Owolabi, L. O. Oyedele, and L. A. Akanbi, “Internet of Things and machine learning techniques in poultry health and welfare management: A systematic literature review,” Computers and Electronics in Agriculture, vol. 200, Art. no. 107266, 2022.

[4] J. Xu, B. Gu, and G. Tian, “Review of agricultural IoT technology,” Artificial Intelligence in Agriculture, vol. 6, pp. 10–22, 2022.

[5] R. Rajak, A. Pawar, S. Pendke, P. Gurav, S. Rathod, and A. Devare, “Internet of Things and smart sensors in agriculture: Scopes and challenges,” Journal of Agriculture and Food Research, vol. 14, Art. no. 100776, 2023.

[6] M. T. Quasim, M. A. Khan, M. A. Alqarni, and M. A. Khan, “An Internet of Things-enabled intelligent monitoring framework for smart agriculture,” Journal of Cloud Computing, vol. 12, no. 1, 2023.

[7] R. Ahmed, M. A. Islam, M. S. Rahman, and M. R. Islam, “Smart packaging technologies for sustainable food supply chains: A review,” Foods, vol. 12, no. 4, 2023.

[8] Food and Agriculture Organization of the United Nations (FAO), The State of Food and Agriculture 2022: Leveraging Automation in Agriculture for Transforming Agrifood Systems. Rome, Italy: FAO, 2022.

[9] United Nations, Transforming Our World: The 2030 Agenda for Sustainable Development. New York, NY, USA: United Nations, 2015.

[10] Direktorat Jenderal Riset dan Pengembangan, Kementerian Pendidikan Tinggi, Sains, dan Teknologi, Panduan Penelitian dan Pengabdian kepada Masyarakat Tahun 2025. Jakarta, Indonesia, 2025.

[11] N. K. Nalendra and H. P. Waspada, “Smart poultry farming: A mobile-based IoT system for real-time broiler monitoring

and management," International Journal of Electrical and Computer Science, vol. 5, no. 1, 2025.

[12] A. Sambas, A. R. Firdaus, M. Mujiarto, G. Gundara, and N. S. Mulyati, "Design of chicken egg farm based on the Internet of Things in Padamulya Ciamis Village, West Java, Indonesia," International Journal of Research in Community Services, vol. 6, no. 2, 2025.

[13] A. Susanto, D. Hidayat, and R. Prabowo, "Development of digital smart community in sustainable poultry agribusiness," Proceedings of the International Seminar on Science and Technology, 2025.

[14] R. Fauzi, A. Nugroho, and S. Prasetyo, "Community empowerment through IoT-based smart agriculture for sustainable rural development," Jurnal Pengabdian Masyarakat Aufa, vol. 7, no. 1, pp. 15–27, 2025.

[15] S. Wolfert, L. Ge, C. Verdouw, and M. J. Bogaardt, "Big Data in Smart Farming: A review," Agricultural Systems, vol. 153, pp. 69–80, 2017.