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Capacity Building Model of Urban Farmer Groups through Participatory Mapping and Visual Dissemination

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ABSTRACT

Background: Urban agriculture has become an adaptive strategy to address the scarcity of agricultural land in cities while promoting food security and social inclusion. In Yogyakarta, particularly within the Kemantren Gondokusuman area, urban farmer groups face challenges related to institutional weakness and limited resource management capacity, necessitating a structured participatory approach to strengthen their institutional effectiveness.
Contribution: This study contributes to the academic and practical discourse on urban agriculture by introducing an integrative participatory framework that connects participatory mapping, visual dissemination, and focus group discussions (FGDs) as tools for institutional transformation. It highlights how participatory and visual methodologies can move beyond data collection to become catalysts for social learning, collective awareness, and adaptive governance in urban farming systems.
Method: A qualitative participatory approach was employed, involving mapping activities, FGDs, and public exhibitions to identify socio-economic potentials, foster stakeholder collaboration, and formulate institutional strategies. Data were collected through field observation, structured interviews, and community workshops, followed by thematic analysis to synthesize findings.
Results: The findings show that participatory mapping enhances collective cognition of local resources and builds cooperative awareness among farmer group members. Visual dissemination through exhibitions facilitates public engagement and legitimacy,

while FGDs translate shared insights into institutional strategies that improve leadership, coordination, and access to external support networks.

Conclusion: The integration of participatory and visual methods plays a critical role in strengthening institutional capacity and fostering the sustainability of urban farming groups. The study provides a replicable model for urban communities in similar socio-spatial contexts, emphasizing that the long-term viability of urban agriculture depends not only on technological innovation but also on participatory institutional strengthening and inclusive community engagement.

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1. Introduction

Urban agriculture has increasingly emerged as a strategic approach to support local food security amid rapid urbanization in Indonesia, including in the city of Yogyakarta. The Yogyakarta City Government has identified this sector as a critical component of its sustainable development agenda in line with the Sustainable Development Goals (SDGs), particularly Goal 2 on food security and sustainable agriculture [1]–[5]. Within the Kemantren Gondokusuman area, urban expansion has created structural challenges limited agricultural land, fragmented land ownership, and weak institutional capacity among farmer groups. In 2024, Yogyakarta City recorded 288 urban farmer groups, an increase from 276 in the previous year [6]. The government targets the establishment of five new groups annually as part of its strategy to enhance food resilience and community empowerment [7]–[9]. Nevertheless, many groups continue to face managerial inefficiencies, limited access to markets, and difficulties in sustaining productive operations [10]–[13].

Urban farmer groups in Yogyakarta have diversified their activities into several productive domains such as direct sale of fresh produce, post-harvest processing, eco-tourism, and educational farming programs [14]–[16]. These initiatives contribute not only to local economic growth but also to strengthening community-based food systems. However, persistent barriers, particularly weak organizational management and limited access to market information, continue to undermine their competitiveness and sustainability [17]–[19]. Most urban agriculture practices in the city remain at household or hobbyist scales, with limited profitability, highlighting the need for institutional strengthening to transform these initiatives into viable community enterprises [16], [17], [20].

Institutional capacity building plays a vital role in empowering community organizations to manage resources effectively and achieve development goals. According to international frameworks, institutional strengthening involves improving governance structures, leadership, knowledge management, and network collaboration to ensure resilience and

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adaptive capacity [21]–[23]. In the agricultural context, capacity building not only enhances individual competencies but also reinforces organizational legitimacy, coordination mechanisms, and access to external support systems [24]–[26]. Studies on urban agriculture governance show that inclusive institutional arrangements can improve farmers' bargaining power, resource efficiency, and program sustainability [31–33]. In line with this, strengthening institutional capacity becomes a strategic foundation for sustainable community development and multi-stakeholder collaboration [27]–[30].

Figure 1 presents a Fishbone (Ishikawa) diagram illustrating the root causes of weak institutional capacity among urban farmer groups in Yogyakarta. The diagram identifies six interrelated factors contributing to institutional fragility: (1) Human Resources, (2) Organization and Leadership, (3) Government Support and Policy, (4) Access to Information and Technology, (5) Access to Financing, and (6) Community Support. Each factor represents a structural dimension influencing institutional performance. Limited managerial competence, inadequate policy support, restricted access to knowledge, and weak social participation collectively constrain the ability of farmer groups to operate effectively. This analytical framework highlights that institutional weakness is systemic, emerging from the interplay between social, economic, and governance dimensions, thus requiring an integrated response combining capacity building, participatory learning, and policy reinforcement.

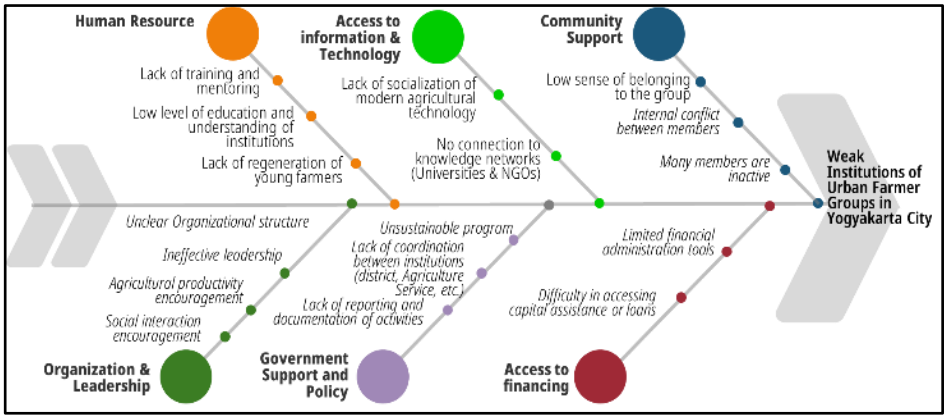

Figure 1. Fishbone diagram, Problems and potential of urban farming groups in Kemantren Gondokusuman, Yogyakarta City (source)

Despite extensive studies on urban agriculture and community-based empowerment, previous research has rarely examined how participatory mapping and visual dissemination can act as complementary strategies for institutional strengthening. Most prior works focus on production techniques, economic feasibility, or environmental benefits [20], [31], yet limited attention has been paid to the social-institutional dimension of how collective knowledge is built and communicated through participatory and visual mechanisms. As noted by [32], public engagement and spatial communication processes are essential in translating urban farming initiatives into sustained institutional action. This study therefore addresses a critical research gap by exploring the interplay between participatory mapping, community learning, and institutional consolidation in the urban agricultural context.

Accordingly, the novelty of this research lies in its integrative analytical framework that connects participatory design, social learning, and institutional capacity building within the same empirical setting. Unlike previous studies that treat participatory mapping merely as a data collection tool, this paper positions it as a catalyst for institutional reflection and adaptive governance. By embedding *visual dissemination*, through exhibition-based public interaction, as an analytical and transformative medium, the study contributes to expanding theoretical discussions on how participatory processes can enhance collective awareness, organizational transparency, and community empowerment. The findings are expected to offer both conceptual and practical implications for developing resilient urban farming institutions across rapidly urbanizing regions in Southeast Asia.

In this study, the focus is directed toward developing a participatory model for enhancing the institutional capacity of urban farmer groups in Kemantren Gondokusuman. The approach integrates participatory mapping, community-based learning, and visual dissemination as tools for identifying spatial, social, and economic potentials within farmer groups. Such participatory and visual strategies have been recognized as effective mechanisms for promoting collective awareness, shared decision-making, and adaptive planning in urban agriculture systems [33]–[36]. Through this integrative model, the research seeks to provide an empirical and conceptual contribution to the discourse on urban farming, demonstrating how participatory mapping and public dissemination can foster stronger, more adaptive urban agricultural institutions [37]–[39].

2. Method

This study was conducted in the Kemantren Gondokusuman area of Yogyakarta City, which hosts 20 active urban farming groups. Additionally, two urban farming activists play an essential role in promoting sustainable agricultural practices and land-use innovation in the area. The selection of this site was based on its representativeness of urban agricultural dynamics in Yogyakarta, where community engagement, spatial limitations, and institutional weaknesses coexist within an emerging ecosystem of urban farming initiatives.

Figure 2. Overview of the activities and conditions of urban farming groups in Kemantren Gondokusuman, Yogyakarta City (source: documentation team, 2024)

Figure 2 illustrates the overall landscape and conditions of urban farmer groups in Kemantren Gondokusuman (source: documentation team, 2024). Assistance and participatory

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engagement were deemed necessary to address both the potential and the challenges in the area. Many farmer groups had begun to develop horticultural products, small-scale processing industries, and agro-tourism initiatives. These activities presented opportunities not only for economic improvement but also for environmental education and community empowerment. Agricultural extension workers and local facilitators played a vital role as knowledge mediators, ensuring the transfer of appropriate technologies and supporting young farmers' capacity development. This collaborative mechanism is essential for achieving sustainable food production and adaptive agribusiness in the face of rapid pressures of urbanization. Increasing public awareness of food security and local production systems has also encouraged active participation in urban agriculture, both as producers and as responsible consumers [40] [41].

This study adopted participatory qualitative research design, combining participatory mapping, focus group discussions (FGDs), and visual dissemination to strengthen institutional capacity. The rationale for selecting participatory mapping lies in its dual function as both a data collection tool and a medium for social learning. As argued by [31], [32] and [33], [35], participatory mapping fosters collective understanding of spatial and social interconnections within a community, while FGDs serve to consolidate group reflections and co-develop institutional strategies. This participatory approach is particularly relevant for capacity building, as it emphasizes shared decision-making, empowerment, and experiential learning rather than top-down intervention [42].

The participants in this study included representatives from 10 selected urban farmer groups (two representatives from each), two agricultural extension workers, and two local community facilitators, resulting in a total of 24 participants. Selection followed a purposive sampling technique, targeting participants who were actively involved in management, production, or organizational coordination within their farmer groups.

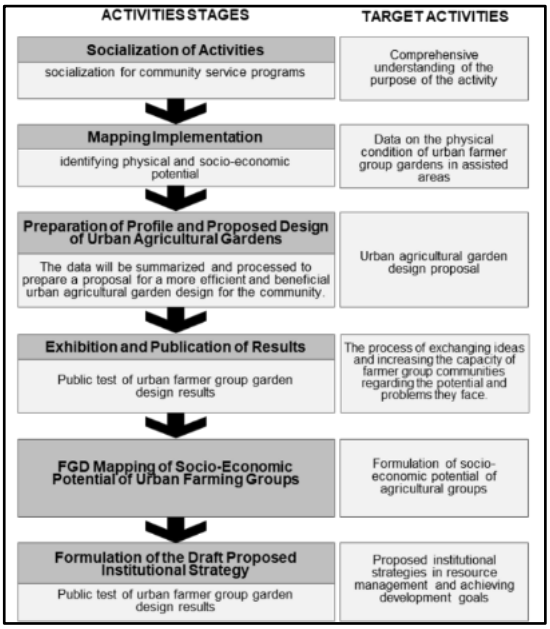

Figure 3. Flowchart of community service implementation methods

Data collection in this study employed three interrelated participatory strategies participatory mapping, focus group discussions (FGDs), and visual dissemination to explore the institutional dynamics of urban farming groups. Participatory mapping was conducted collaboratively with farmer group members to identify spatial, physical, and socio-economic resources within the community, while FGDs facilitated critical dialogue to elicit collective perspectives, constraints, and opportunities for institutional development. The visual dissemination stage, conducted through a public exhibition, functioned both as a medium for validating research findings and as a reflective learning arena to strengthen collective awareness and accountability among participants. The overall process, as summarized in Figure 3, followed a reflective cycle from data generation to feedback and synthesis, allowing iterative learning that underpinned institutional transformation rather than mere activity documentation.

Qualitative data from these participatory processes, comprising field notes, mapping results, interview transcripts, and exhibition reflections, were analyzed using thematic analysis. The analysis involved familiarization with data, coding, theme identification, and synthesis to develop a conceptual model of institutional capacity building. Triangulation across data sources (mapping outputs, FGDs, and observations) ensured validity and reliability, while qualitative content analysis of visual data enabled interpretation of meanings embedded in spatial representations and community narratives. To uphold research ethics, all participants were informed of the study's objectives, provided informed consent, and were assured of anonymity and confidentiality throughout the process.

All participants were informed about the objectives, process, and expected outcomes of the study. Participation was voluntary, and informed consent was obtained from every individual involved. Anonymity and confidentiality of responses were maintained by using coded identifiers in data documentation and reporting. Ethical clearance followed the guidelines for community-based participatory research as outlined by the institution's ethics review board.

The results of this study aim to produce not only a descriptive profile of urban farming groups in Kemantren Gondokusuman but also a set of institutional strategy recommendations grounded in empirical data and participatory reflection. This participatory framework seeks to facilitate community empowerment through collaborative engagement, enabling urban farmer groups to operate more independently, adaptively, and sustainably, thereby contributing to improved urban food security and community well-being.

3. Results and Discussion

3.1. Stages of community service activities

In this community empowerment activity, the team began by conducting a survey and analyzing the situation to identify the main problems faced by the partners. Situation analysis is the process of separating existing problems and consolidating them into a single issue that needs to be resolved and decided upon. This decision was made after several calculations and

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considerations that were deemed effective. This step is considered important because it can provide effective, efficient, and targeted solutions. After the survey, the team identified the main issues of the partners and discussed them with the partners. This identification was carried out through in-depth interviews that focused on the challenges faced by the partners.

Figure 4. Implementation of community service socialization

The initial stage of socialization was held on February 25, 2025 Figure 4. The event involved and also attended by the Head of the Gondokusuman District Office, the Field Agricultural Extension Officer (PPL) of the Yogyakarta City Agriculture and Food Service, and all members of the farmer group in Gondokusuman District area. The open discussion successfully identified the main challenges related to land access and marketing faced by the farmer groups. Socialization also played a role in enhancing participants' understanding of the objectives and benefits of the activities to be carried out. The involvement of various parties, including academics and extension officers, enriched perspectives and built a shared commitment to implementing the mapping program.

Prior to the implementation of the participatory mapping activity, internal coordination was conducted between the research team and supporting students Figure 5 on February 27, 2025. This activity aims to ensure the technical and operational readiness of the team to support the smooth running of the program. Additionally, this coordination is intended to align the understanding of all team members regarding the program's objectives, formulate strategies for implementing activities in the field, and establish effective working mechanisms to ensure that all stages of the activity proceed according to the established plan.

Figure 5. Implementation of participatory mapping involving students

During the mapping phase, activities were carried out in a participatory manner, involving farmer group members to identify the physical condition of the land, cropping patterns, and the socio-economic aspects of the group. A group of 40 students, divided into nine groups, helped record and collect information provided by the farmer groups. The methods applied in this activity included direct surveys, in-depth interviews, and focused group discussions, aimed at increasing collective awareness of the potential resources available

in the farming group's environment. All activities were carried out directly at the farming group's location, enabling the mapping of data and materials to be conducted contextually and reflecting the actual conditions on the ground. This approach allows for more accurate documentation of the existing situation, including the specific strengths and challenges faced by the group. The stages of this activity were carried out between February 28 and March 5, 2025. The results of the mapping then became the basis for the formulation of a more effective and sustainable land management strategy.

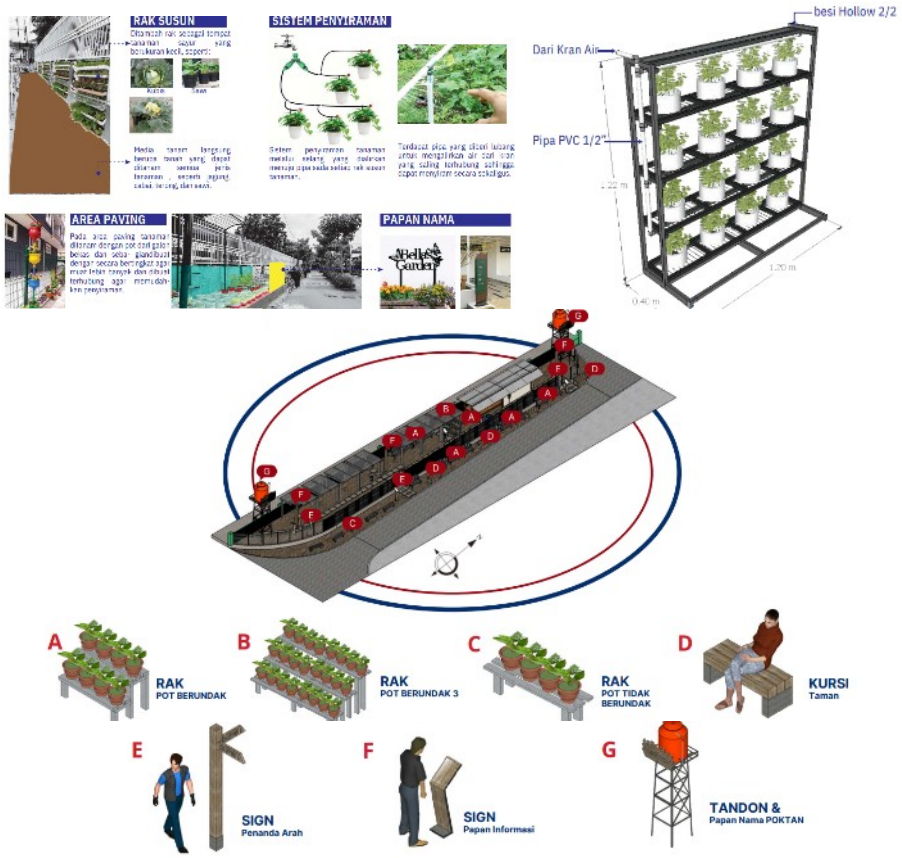

Figure 6. Proposed urban agricultural garden design by a group of student participants

Next, the mapping results were analyzed to develop a proposed urban agricultural garden design by the student participant group Figure 6. This process considered aspects of sustainability, land use efficiency, and the economic potential of the selected agricultural commodities. The proposed design included landscaping that considered the types of plants cultivated, potential community activities, and environmental conditions. In addition, the proposed design also includes fencing, irrigation system design, complementary physical landscape elements (storage, or trash bins), and shade structures that can serve simple functions or as a place to sell the agricultural products produced. Various design alternatives were developed with the aim of ensuring sustainability and long-term benefits for the farming group.

As part of disseminating the results of the activities, a public exhibition was held to disseminate the results of data collection and ideas for urban agricultural garden planning to all members of the farmer group and the community in Kemantren Gondokusuman area. The exhibition, held on March 28, 2025, was an artistic event that not only served as a medium for disseminating the results of the design but also as a space for interaction that encouraged active

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participation from various parties Figure 7. Through visual experiences and open discussions, the exhibition enables farmers' group members, academics, and the public to contribute to evaluating, critiquing, and developing design ideas. Research in the field of museums indicates that a participatory approach in developing exhibition themes and content can deepen public engagement and strengthen interaction between organizers and visitors [40]. Meanwhile, in the context of urban agriculture, public media such as exhibitions have proven effective in raising public awareness, strengthening social responsibility, and building pride in local contributions [43]–[45].

Through visual experiences and open discussions, exhibitions provide opportunities for farmer groups, academics, and the public to evaluate, critique, and develop ideas that have been formulated [46]. Dialogue sessions, workshops, and group discussions further enrich visitors' understanding of the results of mapping and designing urban agricultural gardens. This active participation not only increases engagement but also strengthens a sense of ownership of the activities being developed. Thus, the exhibition serves as a collaborative medium that bridges academic knowledge with practical experience, thereby reinforcing the main objective of the community service program in building the institutional capacity of farmer groups.

Figure 7. Exhibition of mapping results and proposed garden designs

On the same day as the public exhibition, a focus group discussion (FGD) was held in the next session Figure 8. This FGD was conducted to gain deeper insights into the socio-economic potential of farmer groups. The discussion addressed various challenges faced, including limited market access and capital. The FGD also served as a platform for farmer group members to exchange experiences and ideas related to collective farm management [41]–[45]. The results of the discussion emphasized the importance of developing a more systematic capacity-building strategy to improve the welfare and sustainability of the farmer group's business. This session was facilitated by a team of community service workers with the main theme of economic empowerment and improving the quality of urban agricultural production.

Based on the entire series of activities that have been carried out, an institutional strategy has been formulated that aims to strengthen the role of farmer groups in the management and development of their resources. The proposed strategy includes the establishment of a more structured institutional coordination system, improved access to training and technical assistance, and the creation of more efficient marketing mechanisms. The implementation of this institutional strategy is expected to increase the effectiveness of farmer groups in achieving the goals of sustainable urban agriculture development.

Figure 8. Implementation of FGD on economic strengthening

3.2. Comparison with other Project and explanation Main findings

The participatory mapping and institutional strengthening initiatives conducted with urban farmer groups in Kemantren Gondokusuman, Yogyakarta City, align closely with the broader discourse on urban agriculture as an adaptive strategy for sustainable urban development. This research contributes to the growing body of knowledge on urban agriculture that views spatial participation, social learning, and institutional collaboration as essential drivers for urban resilience. Similar to practices observed in other Asian cities, such as Kuala Lumpur, Bangkok, and Seoul, urban farming in Yogyakarta functions as both a spatial and social innovation, addressing land scarcity, urban food insecurity, and the fragmentation of community institutions [36], [43].

From a theoretical standpoint, the findings confirm that participatory mapping is more than a technical data-gathering process; it acts as a mechanism of collective cognition and empowerment. By involving farmers in identifying their physical and socio-economic resources, the mapping process generated a shared understanding of spatial assets and constraints, fostering what [35]. describe as "participatory spatial literacy." This collective awareness enabled farmers to negotiate priorities more effectively, resulting in more context-sensitive land-use plans and management strategies. The process resonates with [36]. argument that spatial co-production can enhance institutional reflexivity and transform local governance structures by strengthening the link between place-based knowledge and decision-making [47], [48].

The second major finding concerns the integration of visual dissemination through exhibitions as a transformative communication strategy. Beyond displaying design results, the exhibitions functioned as public arenas of negotiation, where group members, facilitators, and residents interacted to reinterpret urban agriculture as a shared social practice. This aligns with findings by [43] in Tokyo and [35] in Europe, which highlight how visual media and public showcases cultivate trust, encourage horizontal learning, and expand participation across demographic boundaries. In Gondokusuman, visual dissemination not only strengthened social cohesion among farmer groups but also enhanced the legitimacy of urban agriculture within the broader community. It demonstrated that visibility and recognition are integral components of institutional capacity.

A third core finding lies in the formation of institutional strategies through iterative dialogue during the Focus Group Discussions (FGDs). The deliberative process enabled participants to translate the insights from mapping and exhibitions into actionable institutional frameworks emphasizing renewal of leadership, resource integration, and cooperative networks. These dynamics reaffirm earlier research emphasizing that institutional learning processes, particularly when embedded within participatory structures, generate more

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resilient and adaptive organizations [35], [49]. The emergent strategies in Gondokusuman demonstrate how farmer groups can shift from reactive to proactive management, supported by data-driven reflection and inter-group collaboration.

When compared to community-based agricultural projects in other Indonesian cities, such as Depok or Tejosari Village, the Gondokusuman initiative exhibits a distinctive emphasis on institutional transformation rather than purely physical or economic outputs. For example, while the Depok urban farming program emphasized greenhouse development and economic benefits, and the Tejosari project focused on designing attractive women's farming spaces [50], [51], this study positioned participatory mapping as a cognitive and institutional intervention. This divergence underscores the contribution of participatory design to organizational learning, a process less visible in conventional community service models. Similarly, while Participatory Action Research (PAR)-based initiatives elsewhere have successfully improved waste management and environmental awareness [52], [53], the present study broadens the methodological scope by connecting participatory mapping to organizational restructuring and strategic planning.

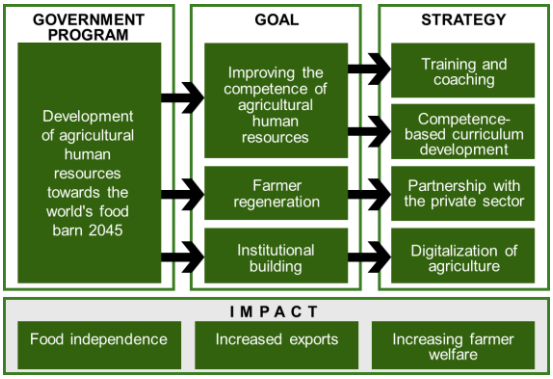

Figure 9. Agricultural Human Resource Development Strategy towards World Food Barn 2045

Figure 9 illustrates Indonesia's *Agricultural Human Resource Development Strategy towards the World Food Barn 2045*, a national policy framework aimed at advancing the competence and resilience of agricultural actors. The diagram demonstrates a logical sequence linking government programs, strategic goals, implementation strategies, and expected impacts. The program's overarching objective is to enhance the competence of agricultural human resources, facilitate farmer regeneration, and strengthen institutional capacity within the agricultural sector. These goals are operationalized through four primary strategies: (1) training and coaching to enhance farmer skills and leadership; (2) competence-based curriculum development to align agricultural education with market and technological needs; (3) partnerships with private sectors to expand innovation and investment; and (4) digitalization of agriculture to optimize productivity and data-driven management.

The expected impacts, food independence, increased export capacity, and improved farmer welfare, reflect a systemic approach that integrates human capital development with institutional and technological modernization. Conceptually, this framework supports the findings of the current study in Kemantren Gondokusuman, where strengthening farmer competence and institutional collaboration at the community level serves as a microcosm of this national agenda. Both approaches emphasize that sustainable agricultural transformation depends on human resource empowerment and multi-level institutional alignment, bridging national policy objectives with localized participatory action.

4. Conclusion

This study demonstrates that participatory mapping and institutional strengthening of urban farmer groups in Kemantren Gondokusuman, Yogyakarta, effectively foster collective awareness, improve land-use efficiency, and reinforce institutional adaptability in the context of urban agriculture. By integrating participatory mapping, focus group discussions, and visual dissemination, the study confirms that participatory design approaches can serve as transformative instruments for community learning and institutional consolidation. These processes have proven capable of translating local spatial knowledge into actionable strategies for strengthening food security and social cohesion in urban environments. The scientific contribution of this study lies in its theoretical integration of participatory mapping, visual communication, and institutional capacity building within the framework of urban agriculture, a synthesis that remains underexplored in previous research. It advances global discourse by demonstrating how visual and participatory methodologies can bridge community empowerment with adaptive urban governance, particularly in rapidly urbanizing contexts in Southeast Asia.

Practically, this study provides an empirical model for local governments, agricultural extension institutions, and urban planning bodies to replicate in developing inclusive and resilient urban farming ecosystems. It highlights the importance of participatory tools not only as methods of data collection but also as mechanisms of co-learning and policy articulation. Nevertheless, this study acknowledges its limitations. The research was conducted within a single urban district, with a relatively small number of farmer groups, which may constrain generalization. Future research should expand the analytical scope across multiple urban regions, employ mixed methods approaches to assess long-term behavioral and institutional change, and explore the digital integration of participatory mapping for broader scalability.

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