# Original Research Article

# Tackling Peri-Urban Food Insecurity Through Modern Agriculture


## ABSTRACT

This study aims to explore the phenomenon of food security and identify the contribution of modern agriculture in overcoming food security problems in the peri-urban area of East Java. In recent decades, the development of Jongbiru areas has undergone a rapid transformation into an urban area where industrial development is relatively rapid and large. This research design is carried out through the Community pilot project development model scheme and FGD with stakeholders in the peri-urban area of Jongbiru, East Java. Through the PRA-pilot project approach, the training revealed improved participants' knowledge and skills regarding modern agricultural methods. Up to 75% of the participants were unfamiliar with hydroponics, but interest in this method increased significantly after participating in the training. Despite challenges in accessibility about their economic viability, further some participants eager to start applicating the hydroponic projects by themselves. These results show great potential for village economic development and support the achievement of the SDGs, such as poverty alleviation, food security, and the promotion of sustainable agricultural innovation. The study also emphasizes the importance of policy and infrastructure support to ensure the initiative's sustainability, which aligns with the literature highlighting the importance of millennial involvement in agricultural innovation.



*Keywords: food security, peri urban, east java, agriculture*




## 1. INTRODUCTION

*Urban farming* is one of the most essential issues in village development [1, 2], Urban farming is one of the most essential issues in village development [1, 2], especially in villages that have undergone a transformation from the agricultural sector to urban areas [3]. Villages close to industrial centres often face challenges in maintaining the traditional agricultural industry [4]. Urban farming plays a vital role in mitigating the impact of this transformation by providing sustainable local food resources and reducing dependence on supplies from outside villages. In its implementation, urban farming contributes to SDGs (Zero hunger) [5,6,7] which aims to end hunger, achieve food security, and improve nutrition. Where, from previos research shows that modern agriculture also contributed to nutritional challenges. Urban farming could be a solution to overcome food supply uncertainty and provide better access to quality food resources for the community. In addition, urban farming also be the alternative efforts in realizing the goals of Sustainable Cities and Communities [8,9,10] by creating a sustainable and inclusive urban environment. By bringing agricultural resources closer to urban communities, urban farming facilitates the optimal use of available land and promotes environmentally friendly village development.

One of the popular methods in urban farming is hydroponics. According to [19], hydroponics is unlike the conventional farming. Hydroponics grows food without the need for soil and plants are grown on artificial or natural substrates and their roots may readily take up nutrients from a ready-made nutrition solution. Hydroponic food gardening can be accomplished in a variety of ways, and the choice of technique relies on a number of variables, including the particular plant, climate, and financial constraints [19]. One type of hydroponic system has several variations such as the Nutrient Film Technique (NFT) where the roots of the plant are partially submerged in a thin stream of nutrients, the Deep Flow Technique (DFT) where the roots are fully submerged in a nutrient solution, the Wick System which uses a wick to channel nutrients, and the Drip System which flows nutrients through droplets [11,12].

Urban and peri-urban agriculture is essential in enhancing the strength of resilient food systems in cities [13,14]. Further, agriculture contributes to diversifying food value chains, improving the livelihoods of urban residents, and ultimately improving urban food security [13,15]. This is because modern agriculture on limited land in peri-urban can be said to be more productive and produce higher yields on limited land compared to agriculture in rural areas due to better access to inputs and labour [15, 16,17]. Thus, the hydroponic farming with a landless farming technique, holds promise in urban areas due to its high yields, climate-smart nature, and ability to control environmental conditions [18]. However, this is also inseparable from several challenges and obstacles. One of them is limited access to inputs (physical capital), pollution risks, and potential negative impacts on the environment [17,19]. High investment costs and lack of knowledge some people and communities are also be major obstacles to adopting hydroponic systems [16,18] in a sustainable way. Further, small-scale implementation in urban and rural settings is particularly difficult due to limited access to suitable technologies [21].

Figure 1a. Rice productivity

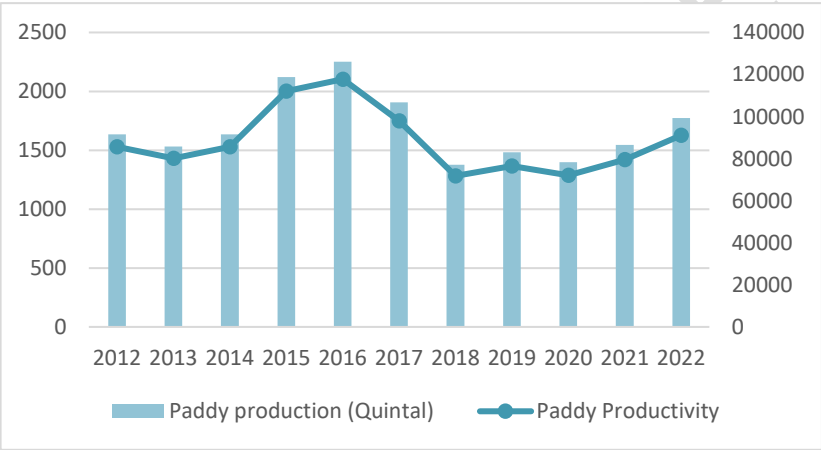
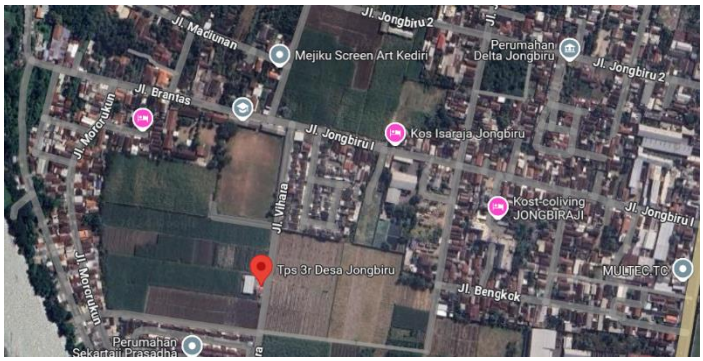



Figure 1b. Jongbiru Village Map




The phenomenon of rapid urbanization also occurs in Jongbiru, East Java. This village is a peri-urban area. In recent decades, it has undergone a rapid transformation into an urban area where industrial development is quite rapid and large. This development has a significant impact on the shift in the social and economic structure in the village. Where originally the community was in the agricultural sector, it must shift towards industry. Thus, food vulnerability is inevitable in this region. From the Figure 1b shows that Jongbiru's green areas have been depleted since settlements, industrial areas, and toll roads were established. This finding is also supported by rice productivity (figure 1a) which has

continued to decline in the past few years. Thus, the problem of increasing population and food insecurity becomes unavoidable. In this case, to increase awareness of food insecurity in the surrounding area, it is important to increase young community knowledge in increasing agricultural production on limited land.

This study aims to discuss in more depth the existing conditions of the peri-urban area in East Java. In previous research, many discussions about modern agricultural innovations and food security have been very influential. However, there is still a few research on the analysis behavioral of implementation of modern agricultural techniques specifically in peri-urban areas that directly target the younger generation to be able to participate in food security efforts but does not consider the aspect of understanding the adaptability of the community, especially the young generation in peri-urban areas, to modern agriculture and its direct impact on local food security. Thus, this study complements the gap through a pilot project to disseminate modern agriculture to the community and the younger generation to improve food security in Jongbiru, Indonesia.

## 2. METHODOLOGY

### 2.1 Material and Methods

Based on the research phenomenon described above, the stages of this research are designed to include three aspects: preparation (situation analysis and consolidation with partners), implementation of activities, and evaluation. The research method used in this activity is a community development approach with Participatory Rural Appraisal (PRA) which involves the community directly as a subject and object in implementing community service activities [22]. This approach encourages active community participation in hydroponic development programs in Jongbiru Village. In some community service activities using participatory methods have shown success in promoting hydroponic agriculture in urban areas with limited land availability, increasing knowledge and enthusiasm among the participants [23].

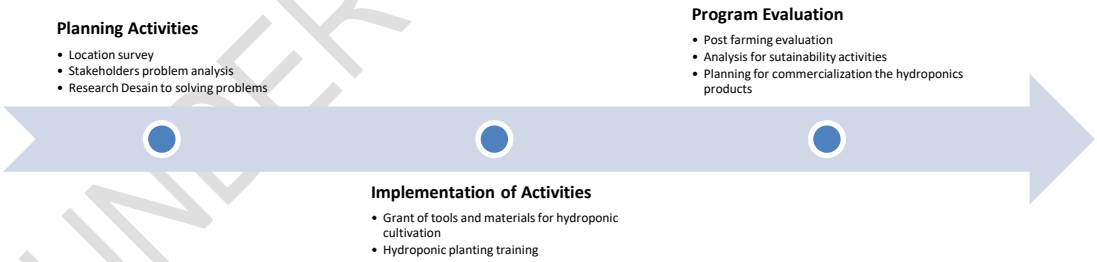



Figure 2. Project flow

The PRA method was initiated to be able to encourage positive interaction among participants and provide insights for environmental educators, although there are several challenges in its implementation. A participatory approach using hydroponic techniques has also been used in urban agriculture initiatives. A model is also used, which emphasizes community involvement in all stages of activities, from planning and implementation to program evaluation. In addition, a persuasive approach is applied by providing appeals and support without elements of coercion, so that the community voluntarily plays an active role

in this activity. The PRA-inspired approach has been used in urban settings to engage young people in learning ethnic gardening practices in community gardens [24].

In several studies with the PRA have explored the factors that affect participation in urban farming projects, including analysis of constraints and participation. The findings above align with the purpose of this research itself, which is to ensure that the program is carried out in accordance with the needs and conditions of the local community. The educational approach, which includes socialization, training, and mentoring, is also applied as a means for knowledge transfer and community empowerment. The targets in this activity include TPS 3R managers, youth organization cadres, women and health cadres, as well as village local government. Finally, balance between these activities is essential at the end of the day. The sustainability of programs that massively move from community participation will be a force in effectively increasing food security.

## 3. RESULTS AND DISCUSSION

The activities of this pilot project are designed in a period of one year where planning activities are the initial stages. The observation results show that there is concern for the local government in the problem of vulnerability that has emerged and is characterized by an increase in the export of several food needs from other cities. Second, the decline in the motivation of the younger generation to agriculture land that still exists and tends to choose to work in the industrial sector. Another finding in the observation section, many people are not aware of the implicit impact of the development of their area as an industry. Technically, the challenge faced by stakeholders (local governments, village communities) is limited infrastructure due to the high cost of installing hydroponic media equipment. Moreover, they also still have a little knowledge to start the aquaponic activity. This finding is in line with several studies [16,18] that state that difficulties in installation costs and knowledge are barriers in the sustainability of hydroponic implementation.

After the planning and observation stages, the implementation stage was start to solve the problems that faced by stakeholders and young communities. The research team provided several physical capital grants as an effort by the community to be able to implement planting activities. This is in line with the team's main goal to be able to introduce modern agriculture in response to being able to adapt to shifting regional functions. In addition, in the second stage, providing knowledge insights to the community is also part of this grant activity. The analysis and service results demonstrate that hydroponic training has the potential to empower the millennial generation and support the achievement of the Sustainable Development Goals (SDGs) in the rural level. From the results of the hydroponic agriculture training for the millennial generation in this village show a significant impact on improving the knowledge and skills of participants related to landless farming methods. An initial survey revealed that before the training, most participants lacked a comprehensive understanding of hydroponics, with 75% being unfamiliar with the technique and only a small percentage having ever tried it. This reflects the initial challenges in changing the millennial generation's interest in the agricultural sector, which has been considered less innovative and less profitable. The involvement of participants in group discussions and hands-on practice, especially in installing simple hydroponic systems, proved to be very effective in improving their understanding of basic hydroponic concepts and techniques.

However, some challenges were identified during the training session. Limited access to hydroponic materials and equipment in rural areas is a significant obstacle that can affect the sustainable implementation of this technique. So this is also be a limitation in this research because the team only provides grants in several village points. Furthermore, there are also advance obstacles to changing the mindset of some participants who still need to be convinced about the economic feasibility of hydroponic agriculture. Nevertheless,

the post-training assessment showed a significant improvement in participants' understanding and skills. Many participants showed interest in applying hydroponic techniques on a small scale in their homes as a first step, which indicates that the training has successfully instilled an interest in sustainable agriculture among millennials.


Figure 3. Implementation activities
Source: author's

After the training, some participants successfully started a hydroponic project at home with the facilitator's support. The project serves as a personal trial and an example for the community, with the potential to evolve into a small business that can improve the family and village economy. This demonstrates the real contribution of this activity to achieving several Sustainable Development Goals (SDGs), such as poverty alleviation (SDG 1), improving food security (SDG 2), and promoting sustainable agricultural innovation (SDG 9), as supported by references [5,6,7]. Furthermore, the active participation of the millennial generation in this activity indicates an increased awareness of the agricultural sector's importance in supporting village sustainability, as well as their motivation to be more involved in community activities focused on sustainable development. To ensure the sustainability of this initiative, a follow-up plan has been prepared, including follow-up mentoring and the establishment of hydroponic farmer groups aimed at strengthening knowledge networks and facilitating the marketing of hydroponic products.

The findings of the research align with several studies that propose a dual-track strategy for involving the millennial generation and improving the livelihoods of smallholders [26]. These studies show that subjective norms and peer pressure influence millennials' intentions to participate in urban agriculture [24]. Urban agriculture improves food security and addresses other urban challenges, such as unemployment and community degradation [27]. To fully harness this potential, policymakers must provide infrastructure, conduct training programs, establish food security departments, and create special land-use zoning for urban agriculture [28,29,30].

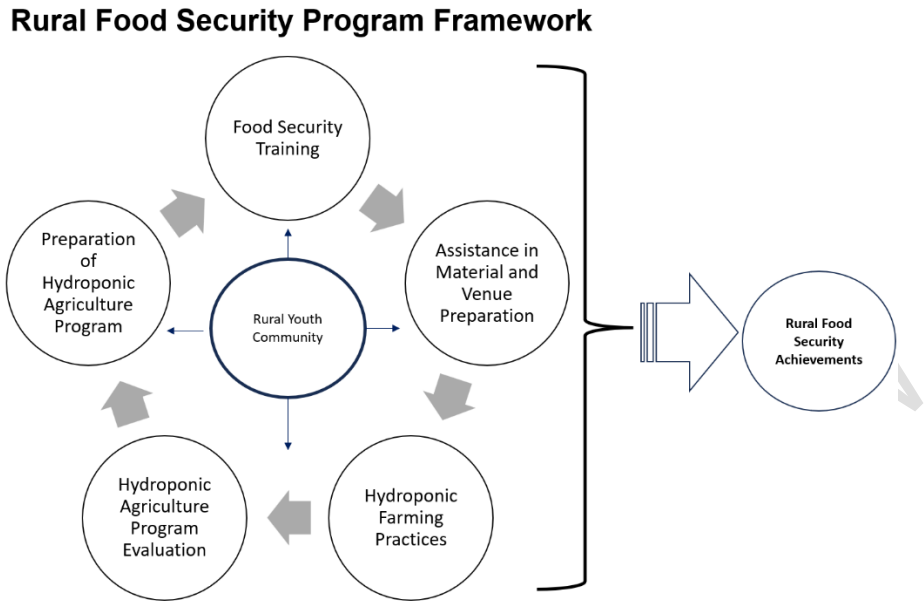



Figure 4. Rural Food Security Program Framework
Source: Author's

Based on the framework summary and activity implementation, it can be concluded that achieving food security in both rural and urban areas requires a central driver, with the community and youth playing a key role in establishing a sustainable urban farming chain. Access to capital for knowledge, information, and supply chains for diversified urban farming (such as hydroponics) products is crucial for pre-implementation. Additionally, food availability, accessibility, stability, and utilization are interconnected factors in achieving sustainable food security. The implementation process starts with local food production to ensure availability for the community. To sustain urban farming programs, food supply stability is essential to ensure consistent availability, unaffected by factors like climate change or market volatility. Ultimately, the focus is on providing the right food to meet daily nutritional needs.

## 4. CONCLUSION

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