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Economic Viability of Community Gardens in Semarang City

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Abstract

Numerous studies have shown that urban agriculture makes substantial contributions to poverty reduction, reduces unemployment, and improves food security. Unfortunately, research on the profitability and economic viability of urban agriculture remains limited. This research aims to explore the economic viability of community gardens as a form of urban agriculture in Semarang City, Indonesia. Semarang city was chosen due to its active implementation of urban farming programs initiated by the municipal government. The research employed a qualitative approach involving 24 participants spread across all sub-districts in Semarang. Data were collected through questionnaires, in-depth interviews, observations, and documentation. Thematic was applied to explore the research findings with the help of NVivo 12 Pro software. The findings indicate that most community gardens operate at a financial loss, showing weak economic viability. Even so, they continue to function sustainably, driven not by profit but by government programs, social cohesion, and environmental concern. This reveals a paradox: community gardens may not generate a profit, yet they remain socially sustainable – sustained more by policy than by market forces. These findings suggest that their sustainability relies more on institutional and communal support than on profit generation. Strengthening government facilitation and community empowerment is essential to ensure their long-term continuity.

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INTRODUCTION

Three of the seventeen Sustainable Development Goals (SDGs) directly address economic and social issues: (1) No Poverty, (2) Zero Hunger, and (3) Decent Work and Economic Growth (Yuan et al., 2022). These goals aim to ensure that every inhabitant of the Earth enjoys prosperity and peace, both today and in the future (United Nations, 2022). These issues are particularly pressing in urban areas across developing countries, including Indonesia. In this context, Semarang City serves as an important case study due to its demographic growth, active urban farming programs, and increasing pressure on food security.

Although all UN member states agreed on the SDGs in 2015 with a target to achieve them by 2030, poverty, hunger, and unemployment remain global challenges. World Bank data revealed that as of March 2023, the global poverty rate stood at 8.5%, with the worst region being Sub-Saharan Africa, which reached 42% and even 60% in Zambia (Mupeta et al., 2020). The International Labor Organization (ILO) predicts that the global unemployment rate in 2024 will remain around 4.9% (ILO, 2024). Similarly, the Global Hunger Index (GHI) reported that the number of undernourished people globally increased from 7.5% in 2017 to 9.2% in 2022. The 9.2% figure is equivalent to 735 million people (Global Hunger Index, 2024), which is 2.6 times the total population of Indonesia in 2024. Even before the COVID-19 pandemic, 14.3 million people in North America had already been affected by food insecurity (Boukharta et al., 2024). Given these figures, the GHI, expressing skepticism over the achievement of the SDGs by 2030, firmly states that 58 countries will not achieve low or zero hunger by that year (Global Hunger Index, 2024). Clearly, achieving these lofty economic and social goals of the SDGs faces formidable challenges that are both real and substantial.

These economic and social challenges become even more pronounced in urban areas, particularly in developing countries, where they are exacerbated by rapid industrialization and urbanization (Hanna & Wallace, 2022). For example, Indonesia recorded an urbanization rate of 57.9% in 2022, which is predicted to rise to 77.1% by 2045 (Giyarsih et al., 2023). In fact, statistics show that more than half of the Earth's population currently lives in cities, a figure predicted to reach 60% by 2030 (Amato & Simonetti, 2021) and almost 70% by 2050 (Yuan et al., 2022). The consequences of this rapid urbanization are predictable: the burden on urban areas to address poverty, unemployment, and food insecurity is becoming increasingly heavy (Boukharta et al., 2024; Mupeta et al., 2020).A contradictory and dilemmatic situation emerges: on the one hand, the world must work hard to achieve the SDGs, which are only five years away; on the other hand, global facts indicate that eradicating poverty, ending hunger, and securing decent work are almost impossible to achieve.

Amidst this contradictory, dilemmatic, and even skeptical situation regarding the achievement of the SDGs, especially in the noble economic and social fields, urban farming has become a global phenomenon (Bhattarai & Adhikari, 2023) This age-old activity (Bhattarai & Adhikari, 2023; Jiang et al., 2024), due to its proven effectiveness in some countries has been encouraged by many researchers to be an alternative strategy to combat poverty (Borges & Matthiesen, 2024; Boukharta et al., 2024; Hasan et al., 2023; Maulana et al., 2022; Mupeta et al., 2020), unemployment (Yuan et al., 2022), and food insecurity (Borges & Matthiesen, 2024; Codato et al., 2024; Giyarsih et al., 2023; Jiang et al., 2024; Mupeta et al., 2020; Yuan et al., 2022). This suggests that urban agriculture represents an economic sector of hope that directly aligns with and supports the achievement of the three economic and social goals of the SDGs.

Studies worldwide have been conducted to test and understand the significance of urban agriculture's contribution to poverty alleviation, unemployment reduction, and food insecurity (Adam-Bradford & Drechsel, 2023; Boukharta et al., 2024; Yuan et al., 2022). However, the

exponential growth of the urban population, driven by high birth rates and rapid urbanization, necessitates the sustainability of these urban farms (Boukharta et al., 2024). At this point, profitability becomes crucial, as the sustainability of urban agriculture is fundamentally determined by its economic viability (Yuan et al., 2022). Unfortunately, research on the financial aspects and profitability of urban agriculture is still minimal (Borges & Matthiesen, 2024), including in Indonesia (Abdillah et al., 2023). This research aims to fill that gap. While numerous studies have explored the social and environmental contributions of urban agriculture, few have systematically and empirically examined its economic viability. Understanding this aspect is essential because the sustainability of urban agriculture depends not only on social engagement and environmental benefits but also on its financial feasibility. In the Indonesian context, studies evaluating whether community gardens can generate a profit or contribute meaningfully to household income remain scarce. Therefore, this study focuses on community gardens in Semarang City to examine their economic viability and to identify the key factors that sustain their continuity despite low profitability.

As the fifth most populous city (Semarang Central Bureau of Statistics, 2024) and the capital of Central Java, Semarang faces the above economic and social challenges. Indeed, urban areas have a lower risk of experiencing food insecurity than rural areas (Rusmawati & Hartono, 2021). However, Table 1 shows that between 2013 and 2023, the number of farming households in Semarang decreased by 25%, and the number of individual farmers shrank by nearly 37%, while the population grew by almost 6%. If this trend continues, it could signal that Semarang could potentially face food insecurity challenges in the future. These challenges will be exacerbated by climate change, global political instability, and conflict (Amato & Simonetti, 2021). Furthermore, in 2023, Semarang's poverty and unemployment rates were recorded at 4.23% and 5.99%, respectively (Semarang Central Bureau of Statistics, 2024).

Table 1. The Number of Semarang's household agriculture, individual agriculture, and population, 2013 – 2023

	2013	**2023**	**Percentage**
Number of households in agriculture	17.623	13.218	-25.05%
Number of Individual agriculture	21.178	13.408	-36.69%
Population	1.572.105	1.659.975	5.59%

Source: Data processed, 2024

In anticipation of these economic and social challenges, it is rational for the Semarang Government to issue Mayor's Regulation No. 24 of 2021, which essentially aims to mobilize and encourage people to engage in urban farming activities. The problem remains: for urban agriculture to be more than just a temporary project and to be sustainable, its economic viability must be ensured. Thus, this study specifically aims to analyze the economic viability of urban farming activities in Semarang City, with a focus on their profitability. Accordingly, the central question this research seeks to answer is whether urban farming in Semarang City is profitable from an economic perspective. If so, how significant is its contribution to the overall household income, making the activity worthwhile to pursue? If not, what does motivate urban farming actors to continue engaging in the activity?

We limited our study to community gardens as the research object, rather than urban agriculture in its broadest sense, which can include urban forests, rooftop gardens, vertical farms, and schoolyard greenhouses (Codato et al., 2024). Community gardens are fascinating because, among the 389 farmer groups and women's farmer groups (hereinafter referred to as farmer groups) registered with the Semarang Agriculture Office (Semarang, 2020), at least 60% are community gardens, as indicated by the researcher's initial survey. This fact is made even

more compelling by the reality that these farmer groups operate on tiny plots of land (a maximum of 900 square meters) with between seven and 45 members. In this context, the question of economic viability, profitability, and especially its contribution to overall household income becomes highly relevant and significant. Moreover, localizing SDGs is essential for achieving SDG targets and goals at the sub-national, national, and global levels (Schwindenhammer & Gonglach, 2021). In that context, this research becomes relevant and significant.

While agriculture has historically been the livelihood of rural communities, urban agriculture has been practiced by people for centuries (Hanna & Wallace, 2022; Jiang et al., 2024; Raja, 2024; Yuan et al., 2022). Nevertheless, there is no universally accepted definition of urban agriculture among scholars (Hanna & Wallace, 2022; Jiang et al., 2024), despite urban agriculture gaining renewed popularity in recent years worldwide (Hasan et al., 2023; Yusuf et al., 2022). Some scholars argue that urban agriculture represents an emerging urban industry that contributes to economic development (Raja et al., 2024; Yuan et al., 2022), while others view it as a means of livelihood or even subsistence (Yuan et al., 2022). Additionally, some scholars limit urban agriculture to crops (Hasan et al., 2023; Raja, 2024; Yusuf et al., 2022), while others include livestock rearing activities (Giyarsih et al., 2023; Jiang et al., 2024). Similarly, some researchers focus on food crops (Kirby et al., 2021; Raja et al., 2024), whereas others incorporate non-food crops, such as forestry and flowers (Yusuf et al., 2022).

Narrowly defined, the common thread among the various definitions is the production of food (plant and animal) in urban areas (in and around cities). The Food and Agriculture Organization (FAO) broadly defines urban agriculture as the growing, processing, and distribution of food and other products through intensive cultivation of crops and livestock in urban areas and surrounding areas, (re) utilizing natural resources and urban waste to obtain diverse crop and livestock yields (Kusmiyati, 2021). Urban agriculture can take many forms, including urban farms, community gardens, school gardens, allotments, rooftop gardens, and greenhouses (Boukharta et al., 2024; Jiang et al., 2024; Raja et al., 2024). In this study, we limit ourselves to community gardens, as defined by Boukharta et al. (2024), which are open spaces collectively managed, cultivated, and maintained by members of the local community for growing food or flowers, with a maximum area of 1000 m^2. Boukharta et al. (2024) and Yuan et al. (2022) identified four primary reasons why people engage in urban agriculture: subsistence, economic, recreational, and community-building. However, this study found that government programs also strongly influence why people engage in urban agriculture in Semarang City.

The urgency and popularity of urban agriculture ebb and flow with the context of the times. Specifically, it often emerges as a beacon of hope and an alternative strategy when the world or society faces, especially, economic difficulties, and fades when the situation improves (Amato & Simonetti, 2021; Bhattarai & Adhikari, 2023; Boukharta et al., 2024). Before the Industrial Revolution (1760-1830), agriculture was one of the basic functions of urban society. However, this function diminished as the Industrial Revolution changed production modes (Hanna & Wallace, 2022) to become more effective and efficient. When the world faced economic upheaval (1893-1897), urban agriculture again attracted people's attention (Raja, 2024). However, when the economic situation stabilized, urban agriculture was forgotten. This pattern repeated during World War I (1914-1918) and World War II (1939-1945). Urban agriculture again became the foundation for the community to face these difficulties. During these periods, the term "war gardens" or "victory gardens" emerged as a means of supplementing food supplies. However, post-war economic recovery led to the decline of urban agriculture once more. The cycle continued, with urban agriculture resurfacing during the Great Depression of the 1930s as a

vital strategy for dealing with widespread poverty and food insecurity. The development of the food industry in the 1950s further contributed to its decline.

The urgency and popularity of urban agriculture returned as a global phenomenon during the Covid-19 pandemic (Amato & Simonetti, 2021; Bhattarai & Adhikari, 2023; Boukharta et al., 2024; Maulana et al., 2022; Raja, 2024; Yusuf et al., 2022). The pandemic disrupted food production and distribution chains (Lal, 2020), raising public awareness of the need for shorter and more resilient food supply chains, particularly in urban areas facing uncertainty (Amato & Simonetti, 2021; Oh & Chungui Lu, 2022; Yuan et al., 2022). Yusuf et al. (2022) specifically noted that post-COVID-19, urban residents felt a heightened need to farm as a means of reducing dependency on supermarkets. This trend highlights the growing demand among city dwellers for immediate access to fresh vegetables and other food items (Bhattarai & Adhikari, 2023).

In the Indonesian context, Maulana et al. (2022) observed that urban agriculture began to flourish during the 1997 economic and monetary crisis. This crisis compelled people to confront economic hardship, prompting them to turn to urban agriculture as a viable means of coping with their financial struggles. The passion for urban farming was reignited during the COVID-19 pandemic.

Poverty, from an economic standpoint, refers to a person's inability to fulfill their basic needs due to a lack of monetary resources (Rahoyo et al., 2024). Essentially, poverty is a manifestation of inadequate purchasing power. This lack of purchasing power often results from insufficient income (on the demand side) or prohibitively high food prices (on the supply side), making necessities unaffordable. At this point, it is clear that poverty is closely linked to unemployment.

Urban agriculture can serve as a tool to address, or at least mitigate, economic challenges such as unemployment and poverty (Yuan et al., 2022). The role of urban agriculture in Zimbabwe provides a relevant case study. Kanosvamhia (2024) revealed that urban agriculture can be an alternative occupation for unemployed youth and retirees. His study showed that 60% of urban farming participants earned significant income from these activities. Similarly, an empirical study by Mupeta et al. (2020) found that among 2,682 households surveyed in Zambia, household income increased by 13.7% to 19.1% due to the adoption of urban agriculture. This suggests that, from the demand side, urban agriculture strengthens purchasing power by providing income to the unemployed or offering additional income to households (Bhattarai & Adhikari, 2023; Yuan et al., 2022). On the supply side, urban agriculture extends the food supply chain to urban areas while shortening the distribution channels (Amato & Simonetti, 2021; Hanna & Wallace, 2022). This dual role leads to lower food prices in urban areas by increasing supply (Grebitus, 2021) or reducing demand through subsistence farming, and by decreasing food distribution costs (Boukharta et al., 2024; Mupeta et al., 2020; Yusuf et al., 2022), ultimately contributing to poverty reduction.

Food security refers to a condition where everyone has access to safe, nutritious, and sufficient food, both economically and physically, and socially. It can be measured by availability, affordability, and utilization (Oktiani & Khoirunurrofik, 2024), conversely, food insecurity. Various factors can trigger food insecurity, including climate change, global warming, disasters, pandemics, political instability, and war (Amato & Simonetti, 2021; Yuan et al., 2022).

Urban agriculture plays a significant role in addressing food supply challenges (Abdillah et al., 2023; Boukharta et al., 2024). Jiang et al. (2024) highlight that urban agriculture in contemporary China aims to meet the food needs of urban communities. Similar observations were made in Buffalo, New York, and Detroit, Michigan, where urban agriculture provides food for thousands of families each harvest season (Raja et al., 2024). These examples support the conclusion that urban agriculture can be an effective strategy to enhance food security (Abdillah et al., 2023; Jiang et al., 2024).

Theoretically, the relationship between the economic viability of urban agriculture and the achievement of the 2030 SDGs can be conceptualized as illustrated in Figure 1. Figure 1 presents a conceptual framework illustrating the logical connection between the economic viability of urban agriculture (UA) and the achievement of three key Sustainable Development Goals (SDGs): SDG 1 (No Poverty), SDG 2 (Zero Hunger), and SDG 8 (Decent Work and Economic Growth). This figure serves as the theoretical foundation for the study, suggesting that urban agriculture can significantly contribute to achieving socio-economic development targets, provided it is economically viable. As shown in Figure 1, the viability of urban agriculture is the first link in a causal chain that leads to achieving the SDGs. This study's findings, which highlight low profitability and low-income contribution, suggest a break in that chain, signaling that urban farming in its current form may fall short of supporting SDG 1, 2, and 8. Without stronger economic foundations, urban agriculture may remain socially valuable but structurally unsustainable.

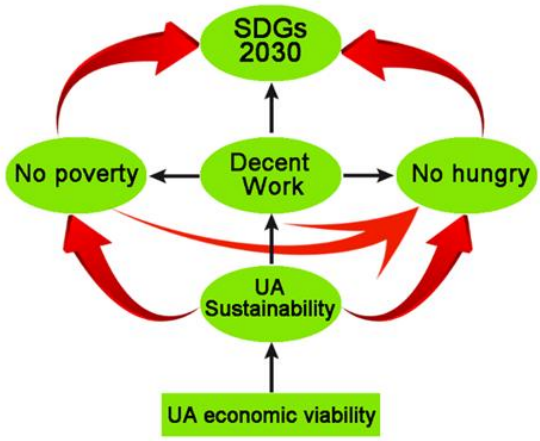

Figure 1. Urban Agriculture (UA) economic viability and SDGs 2030 Achievement

RESEARCH METHODS

This research employed a qualitative approach grounded in the constructivist paradigm, which emphasizes the socially constructed nature of reality and the importance of understanding participants' subjective meanings in context (Creswell, 2023; Sundaro, 2022). In line with this paradigm, the study adopted inductive strategies to explore emerging patterns and meanings(Johnson & Christensen, 2021; Rahoyo et al., 2025). A qualitative approach was chosen over a quantitative one to explore and elaborate on the phenomenon of urban agriculture, aiming to gain an in-depth understanding within a specific context (Levitt et al., 2021). Therefore, this research does not seek to make statistical generalizations (Rahoyo et al., 2025). Data were analyzed using thematic analysis (Braun & Clarke, 2021).

Primary data were collected through questionnaires, in-depth interviews, observation, and documentation. Secondary data, particularly the list of farmer groups in each urban village and sub-district of Semarang, were obtained from the Central Java Province website (https://data.jatengprov.go.id). Additional secondary data were sourced from various journals and websites.

The research process spanned approximately seven months, with field research conducted from mid-March 2024 to the end of May 2024 in Semarang. Initially, the research population included all farmer groups across all sub-districts in Semarang. However, two sub-districts, Gunungpati and Mijen, were excluded because the characteristics of their farmer groups predominantly consisted of individual farmers with rice fields or farms (suburban farmers), rather than community gardens, which is the focus of this study.

The survey was conducted face-to-face with a sample of 24 farmer groups, selected proportionally using the cluster random sampling method (Etikan & Bala, 2021). From these 24 respondents, who were generally represented by group leaders, 13 informants were then selected through a purposive and accidental snowball sampling method (Naderifar et al., 2021). The sampling process followed a sequential design: first, cluster random sampling was used to select farmer groups from stratified districts; second, purposive sampling identified key informants based on their group roles and experiences; and finally, snowball sampling was employed to

reach additional relevant participants recommended by earlier participants. Additionally, in-depth interviews were conducted with two employees of the Semarang City Agriculture Office, utilizing a semi-structured interview format both in groups and individually.

The data analysis process followed the model introduced by Miles and Huberman, which includes data collection, data display, data reduction, and conclusion drawing/verification (Mohajan, 2022). To integrate both structure and depth, the Miles and Huberman model provided the analytical framework for organizing the stages of analysis, while thematic analysis guided interpretation through the identification of themes. These two approaches were integrated to ensure both systematic handling and in-depth interpretation of qualitative data. These processes were carried out simultaneously and continuously, rather than linearly. Figure 2 illustrates the sequential analytical process adopted in this study. Each link represents a stage of the qualitative analysis—from data collection, transcription, and coding to theme identification, interpretation, and synthesis—forming a continuous loop that ensures the validity and coherence of findings. The process culminates in the conclusion, which is derived through the iterative verification and integration of all analytical stages.

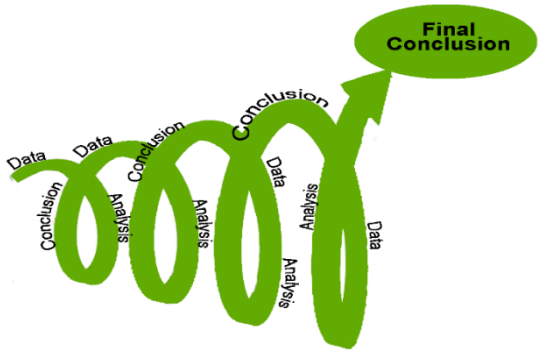

Figure 2. The analysis process
Source: Rahoyo et al. 2024

All in-depth interviews were recorded with a digital voice recorder, totaling 3 hours, 97 minutes, and 37 seconds, and the recordings were then transcribed verbatim. Microsoft Excel 2013 was used to compile the results of the questionnaire; the next step involved coding the interview transcripts, questionnaire results, and reference articles. Coding, including both open coding and axial coding, was conducted using NVivo 12 Pro software. Based on the coding, themes were identified and developed as research findings. Urban agriculture inherently generates income (Bhattarai & Adhikari, 2023), which impacts the household income of urban agriculturalists. In instances where urban farming is not the sole livelihood of the practitioners, total household income comprises both non-farm work income and agricultural income (Mupeta et al., 2020). The total household income can be expressed mathematically as follows:

$$TI = Ina + Ia_{net} \quad \text{..... (1)}$$

Where, TI is Total income, Ina is Non-agricultural income, and Ia_{net} is Agricultural net income.

Agricultural net income (Ia_{net}) is defined as income from agriculture minus total costs (Rosyidi, 2019; Salvatore, 2014). Mathematically:

$$Ia_{net} = Ia - TC \quad \text{..... (2)}$$

Where Ia represent Agriculture income, and TC represent Agricultural total cost.

The contribution of agricultural income to total household income can be calculated using:

$$C = \frac{Ia\ net}{TI} x\ 100\% \quad \text{..... (3)}$$

Where, C is contribution of agricultural net income to total income.

A larger C-value indicates a greater contribution of agricultural activities to total household income, suggesting higher viability of urban agriculture. Conversely, a smaller C-value reflects a lesser contribution and lower viability. The issue arises when agricultural income is negative, resulting in a negative C-value, as observed in this study, which raises the question of whether urban agriculture is viable under such conditions.To determine the intra-cluster patterns of farmer groups and compare them with patterns in other clusters, respondents were classified into 4 clusters: Cluster A, Cluster B, Cluster C, and Cluster D. Clustering was based on two criteria: the results of their farming

activities (harvest) and member engagement or activeness. Each dimension was operationalized using clear and objective indicators. Harvest outcomes were assessed based on whether produce was sold (score = 3), consumed only (score = 2), or not harvested at all (score = 1). Group engagement referred to the presence of routine collective activities (score = 3), irregular activities (score = 2), or the absence of any group activity (score = 1). These scores were then combined into a 1–9 scale to reflect both productivity and participation. A score of 3 for harvest indicated market-oriented production, while a score of 1 reflected no harvest. Similarly, a score of 3 for engagement indicated structured, regular group activities, while a score of 1 represented complete inactivity. Figure 3 illustrates the scoring matrix used to combine the two dimensions. Accordingly, scores of 8-9 were categorized as Cluster A, scores of 6-7 as Cluster B, scores of 4-5 as Cluster C, and scores of 1-3 as Cluster D.

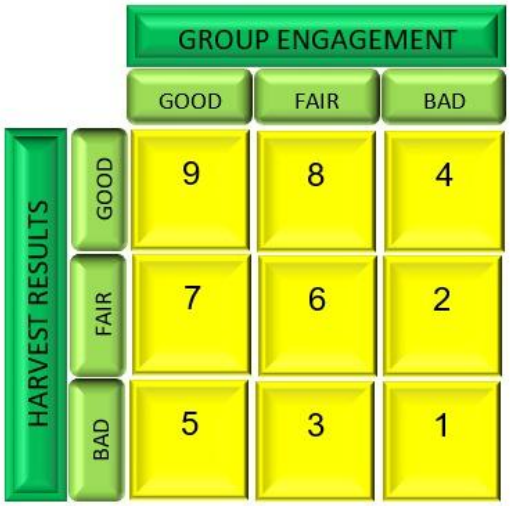

Figure 3. Farmer groups score matrix
Source: Rahoyo et al. 2024

RESULTS AND DISCUSSION

Semarang City, covering an area of 373.78 km², is divided into 16 sub-districts and 177 villages. The largest sub-districts are Gunungpati (58.27 km²) and Mijen (56.52 km²), while the smallest are East Semarang (5.42 km²) and Central Semarang (5.17 km²). Gunungpati and Mijen also have the highest altitudes, recorded at 311 and 300 meters above sea level (ASL), respectively. As of 2023, Semarang's population was recorded at 1.69 million, resulting in a population density of 4,534 people/km² (Semarang Central Bureau of Statistics, 2024). The city's poverty rate was 4.23%, and the open unemployment rate stood at 5.99%.

The 8,062 registered farmers in Semarang, more than half are located in Gunungpati (2,119 farmers) and Mijen (1,932 farmers) (Semarang City Department of Agriculture, 2022). This observation substantiates the indication that farmers in these two sub-districts typically manage relatively extensive landholdings and engage in individual rather than collective cultivation practices. Consequently, Gunungpati and Mijen were excluded from the sampling framework, as their agricultural conditions differ from the study's focus on community-based urban gardening. The Semarang Agriculture Office (2022) also reports that the areas of paddy fields and moorland are 3,959.65 ha in Gunungpati and 2,631.59 ha in Mijen. In comparison, Ngaliyan, the third-largest sub-district in terms of paddy fields and moorland, has only 877 ha.

Of the participants in this study, 58.3% were female and 41.7% male. If these figures reflect the broader population, it can be concluded that the majority of community gardeners in Semarang are women. This observation is further supported by the fact that the heads of the participant farmer groups were often women, including the wives of local leaders such as the neighborhood (RT) head, citizens' association (RW) head, PKK Chairperson, and Dasa Wisma Chairperson. This gendered pattern confirms the argument of Aquino & Mercado (2022), who found that women often dominate urban agriculture activities across Southeast Asia due to their social capital and community leadership roles.

Age-wise (Yeptro, 2024), 54.2% of participants belong to Generation X, 37.5% to the Baby Boomer Generation, and 8.3% did not specify their age. This indicates that community gardens in Semarang are primarily run by women of productive age, with no involvement from Millennial or Generation Z. This generational composition reflects the trend identified by Yusuf

et al. (2022), in which urban farming initiatives are more attractive to older generations seeking social engagement rather than income-oriented entrepreneurship.

Regarding employment, only 8.3% of participants have jobs with relatively fixed working hours, while the majority (91.7%) have flexible schedules. These participants include retired civil servants, homemakers, micro-entrepreneurs, and those with odd jobs. Whether working with flexible hours is their choice due to educational factors and living in an urban area (Khazanah & Firmansyah, 2024) is a topic not explored further by this research. However, this flexibility allows community gardens to serve as a form of self-employment for the unemployed or those with ample free time, similar to findings by Yuan et al. (2022) in Kenya. This indicate that community gardening in Semarang functions as a socio-economic buffer, a concept consistent with the livelihoods framework proposed by Mupeta et al. (2020), where urban farming serves as a safety net in times of economic uncertainty. Using the score matrix in Figure 3, the composition of farmer groups per Cluster is shown in Figure 4.

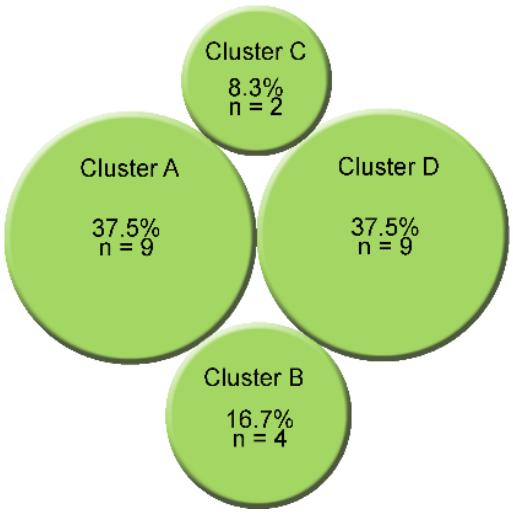

Figure 4. Farmer groups cluster
Source: Data Processed, 2024

Figure 4 illustrates that the number of participants in the two diametrically opposite clusters—A (highest score) and D (lowest score)—is equal, with both clusters comprising a significant portion of the total, at 75%. This distribution is important for drawing valid and reliable conclusions, both within individual clusters and for inter-cluster comparisons. Since clustering is based on yields and the level of member engagement, the size of the land cultivated by a farmer group does not determine its cluster assignment. For example, Respondent 1 belongs to Cluster D despite cultivating 100–200 m², while Respondent 2 is in Cluster A with less than 100 m² under cultivation.

When participants were asked, "Based on your experience in 2023, comparing income and expenses, is this type of farming activity profitable or loss-making?" 62.5% reported a loss, 20.8% reported a profit, and 16.7% did not provide an opinion. Generally, participants did not keep detailed records of their income and expenses, so the question was limited to 2023 to allow for a more accurate recall of their financial situation. Participants' revenue calculations included not only the money received from sales but also the estimated market value of crops consumed personally or distributed to non-farmer group households. Notably, they excluded their own labor costs and land rent.Respondent 13, a Cluster A participant with the highest score of 9, reported relatively the best results among the five participants scoring 9, sharing the following: "Average sales per month range between Rp1 million and Rp1.5 million. Expenses for maintenance and labor that we cannot do ourselves are around Rp750,000 a month." (Interview, April 25, 2024).

The analysis revealed that Respondent 13's community garden generated gross sales between Rp 12,000,000 and Rp 18,000,000 during 2023, with total expenses amounting to Rp 9,000,000. This resulted in a net profit of Rp9,000,000 for the group in 2023. Distributed among the 23 members of the farmer group, this equates to approximately Rp33,000 per person per month, or just Rp1,100 per person per day—a figure far below the daily labor wage in Semarang (Rp50,000 per day). This finding aligns with the conclusion of Yuan et al. (2022), who found that urban agriculture generally offers limited financial returns, underscoring the idea that its value lies more in social and environmental benefits than in economic profit.

These figures suggest that the perceived profitability of urban farming may be misleading when analyzed on a per capita basis, especially in group-based arrangements. Although the activity may yield a net surplus in aggregate terms, its contribution to individual household income remains marginal.

Respondent 6, also from Cluster A, provided a different account: "The harvest during 2023 was about Rp5 million. The harvest was consumed by group members and distributed to non-member neighbors. Maintenance, seeds, etc., cost around Rp14 million in 2023." (Interview, April 20, 2024).

Respondent 6 incurred a substantial loss of Rp9.4 million in 2023, which was effectively offset by the monthly transportation allowance received by the respondent in their capacity as the neighborhood head.

It is essential to note that Respondent 13's calculation did not include land rent costs, as the land—a public facility owned by the Community Association—was used at no cost. Additionally, labor costs for daily maintenance and watering, performed alternately by group members, were not included. Thus, even if Respondent 13 considers their farming activities profitable, including land rent and labor costs would likely result in a loss. This reflects a broader pattern in which the viability of urban farming is often subsidized by non-agricultural resources—such as unpaid labor and access to free public land—which may not be replicable across different contexts. This observation is consistent with the argument of Borges & Matthiesen (2024), who highlight that many community gardens rely on external support mechanisms that challenge their financial independence and long-term viability. Similar economic challenges of urban farming have also been observed in various low-income urban areas in Indonesia.

While interviews with Respondent 6 and Respondent 13 indicate that losses are not confined to a particular cluster, Figure 5 details the profit and loss perceptions broken down by farmer group cluster.

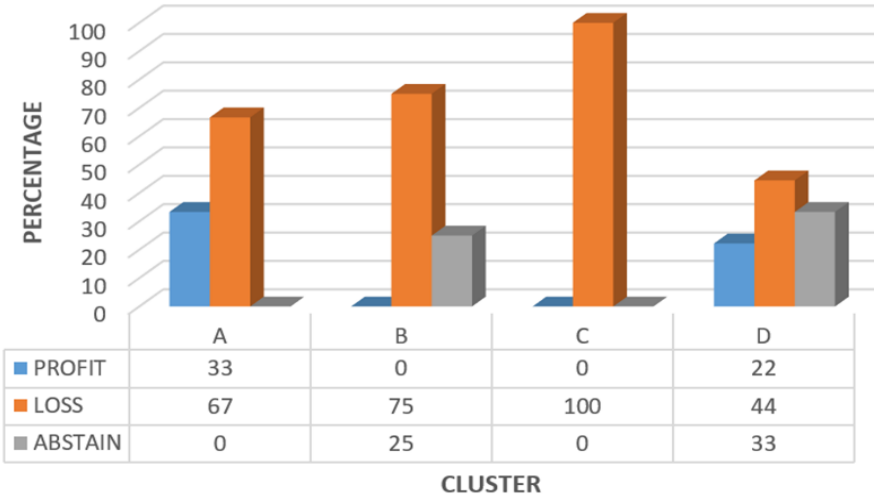

Figure 5. Profit-loss perception by farmer group cluster.
Source: Data Processed, 2024

Figure 5 shows that 67% of Cluster A participants reported a loss, while 33% reported a profit. In Cluster B, 75% reported a loss, 25% abstained, and none reported a profit. In Cluster C, all participants (100%) reported a loss. In Cluster D, 44% reported a loss, 33% abstained, and 22% reported a profit. These data indicate that perceptions of profit and loss are not concentrated in any specific cluster. Overall, 62.5% of all participants viewed community gardens as a loss, 20.8% as a profit, and 16.7% had no opinion. It can thus be concluded that across all clusters, most farmer groups perceive

urban agriculture, particularly community gardens, as a loss-making endeavor.

Despite the expectation that Cluster A (high-performing groups) would perceive greater profitability, the data show that even the most active and productive groups report financial losses. This pattern suggests that performance indicators, such as engagement and productivity, alone are insufficient predictors of financial success in community-based farming. The finding aligns with Bhattarai & Adhikari (2023), who observed that community gardens in Nepal also face similar structural barriers despite high participation.

These findings imply that the economic viability of urban agriculture, regardless of group performance, is currently weak. Consequently, its contribution toward achieving SDG 1 (No Poverty), SDG 2 (Zero Hunger), and SDG 8 (Decent Work) remains limited. Without profitability, the sustainability of urban agriculture is undermined, weakening its role as a development strategy aligned with the 2030 SDGs.

This outcome resonates with Codato et al (2024), who argue that the social dimensions of urban agriculture can compensate for its economic fragility, transforming it into a platform for empowerment and local resilience.

However, the continued operation of many community gardens despite recurring losses suggests that their motivation has evolved beyond profit. For several groups, urban farming now serves as a form of self-reliance and social empowerment, providing non-economic benefits such as environmental awareness, social cohesion, and neighborhood collaboration. This transition from a profit orientation to social empowerment mirrors the findings of Amato & Simonetti (2021), who conceptualize urban agriculture as a catalyst for inclusive urban regeneration rather than a purely economic enterprise.

On the other hand, if economic gain remains a key objective, government support should focus on capacity building, cooperative marketing, and access to broader markets to help farmer groups reach real financial viability while preserving their social value. This recommendation aligns with Kanosvamhira (2024), who emphasizes the critical role of institutional support and policy integration in transforming small-scale urban farming into sustainable economic systems.

Most farmer group leaders in this study (58%) hold positions of authority, while 42% do not. Authority may be formal (e.g., wife of the RT head, RW head, PKK head, Dasa Wisma head) or informal (local community leaders). This bureaucratic authority could influence responses regarding profit and loss. Specifically, the expectation was that 58% of authoritative group leaders might claim that the community garden is profitable, potentially skewing the data. Figure 6 explores this tendency.

Figure 6 illustrates whether farmer groups are led by authoritative figures and their corresponding perceptions of profit or loss. For example, Respondent 24, led by a layperson, reported a loss, while Respondent 22, led by an authoritative figure, also reported a loss. Analyzing all data in Figure 6 reveals that 60% of farmer groups led by laypeople reported a loss, 20% reported a profit, and 20% abstained. Among groups led by authoritative figures, 64% reported a loss, 22% a profit, and 14% abstained. This suggests that perceptions of profit and loss are not strongly related to the authority of the group leader.

Visually, Figure 6 shows that the data points for both categories—authoritative and non-authoritative leaders—are spread evenly across the profit and loss dimensions, without forming any distinct clusters. Most points are concentrated in the loss category, indicating that unprofitability is common across both leadership types. The uniform distribution pattern confirms that leadership authority alone does not determine group performance, and that external factors such as access to resources, market networks, and member participation may play more substantial roles in shaping economic outcomes.

This finding highlights that leadership authority does not necessarily guarantee better performance or a more favorable perception of

profitability. Community gardens may operate under various forms of leadership, but other factors—such as access to resources or group dynamics—appear to be more influential in shaping financial outcomes.

In relation to Figure 1, these findings imply that authority structures alone are insufficient to ensure the economic viability of urban agriculture. Since profitability perceptions remain low across both authoritative and non-authoritative groups, the potential of urban agriculture to support SDG 8 (Decent Work) through enhanced livelihoods remains constrained. Strengthening technical support, equitable resource distribution, and capacity building may be more effective strategies for increasing the sustainability of urban agriculture and its contribution to SDG targets

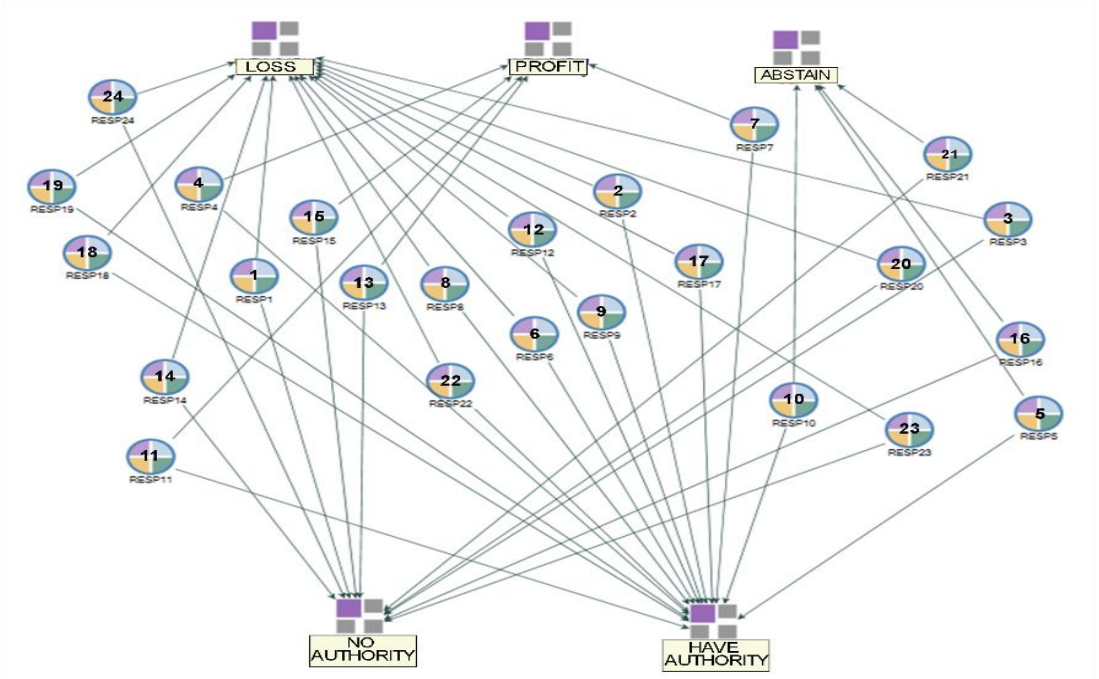

Figure 6. Authority and benefit-loss perception
Source: Data Processed, 2024

Figure 7 shows that profit perception improves significantly as the cultivated land area increases, while loss perception is more prevalent in groups with smaller land sizes. Visually, the proportion of "profit" responses increases steadily as the cultivated area expands, suggesting that scale has a strong influence on economic perception. This pattern suggests that limited land constraints productivity and efficiency, resulting in higher costs per unit of output.

By excluding all abstentions, Figure 7 can be summarized as a curve, as shown in Figure 8. This curve illustrates a clear relationship between cultivated land size and profit or loss perceptions: larger land areas are associated with a higher likelihood of reporting profitability (positive slope), while smaller areas are associated with a higher likelihood of reporting losses (negative slope).

Visually, the curve in Figure 8 rises steadily from left to right, with the steepest gradient occurring between 100 and 200 m², indicating that this is the critical threshold where farming scale begins to influence profitability perception. Beyond 200 m², the curve flattens, suggesting diminishing marginal returns once sufficient land area is achieved. This visual trend reinforces the notion that small-scale plots face structural inefficiencies, while mid-sized and large plots approach viability.

These patterns reinforce the conceptual model in Figure 1, where the economic viability of urban agriculture—reflected in profitability—is a prerequisite for sustainability. In turn, this sustainability becomes essential for supporting

SDG 1, 2, and 8, particularly in dense urban settings like Semarang. Thus, increasing access to cultivable land could be a structural intervention to enhance UA viability and its developmental contribution.

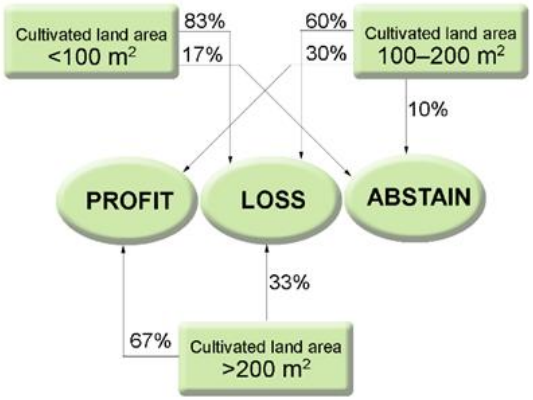

Figure 7. Profit and loss perception by cultivated land area
Source: Data Processed, 2024

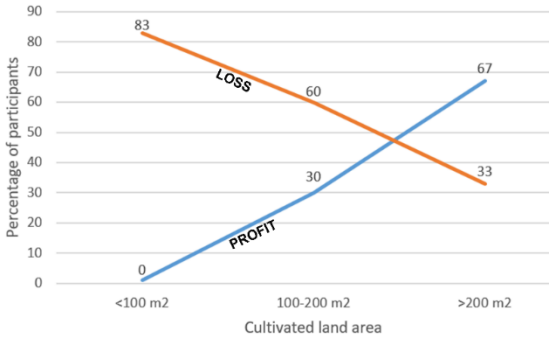

Figure 8. Tendency to answer profit and loss based on the cultivated land area
Source: Data Processed, 2024

The study by Mupeta et al. (2020) in Zambia expands this horizon by demonstrating that urban agriculture can increase household income by 19.1%. Notably, urban farmers in Zambia cultivate an average of 4,500 square meters of land. Similarly, Ammatillah et al. (2018) in their research on urban agriculture in Jakarta's Special Region, show that urban agriculture can be a primary source of support for farmers' household income, provided that the cultivated land per capita reaches 1,950 m². When comparing these cases to the farmer groups participating in this study, which cultivate land areas ranging from a maximum of 900 m² to as small as less than 100 m², with groups consisting of between 7 and 45 members, it becomes clear that there is a significant relationship between the size of the cultivated land and the perceived profitability of urban farming activities. The question of what the ideal land area per capita is to achieve economies of scale requires further research.

Since the net income from agriculture (Ia_{net}) in this study is negative, the question of how much Ia_{net} contributes (C) to total income (TI) to make it worthwhile is no longer relevant. The important question is, what motivates them to continue community gardening? It is essential to note that the participants began community gardening between 2011 and 2020, indicating that the youngest farmer groups have been active for at least nine years. How have they managed to survive for at least four years, and in some cases, more than ten years, despite incurring losses? Figures 9 and 10 provide insight into this question.

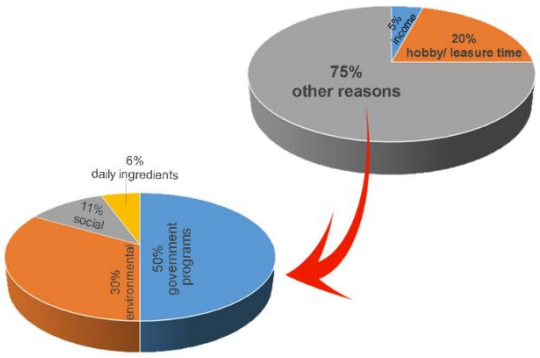

Figure 9. Participants motivation
Source: Data Processed, 2024

Figure 9 explains that there are three primary reasons why people engage in community gardening in Semarang: (1) to increase their income, (2) as a hobby or leisure activity, and (3) for other reasons. The "other reasons" are further broken down into (1) providing daily kitchen ingredients, (2) social reasons, (3) environmental reasons, and (4) government programs.

Participants noted that community gardens contribute to a cleaner, greener environment and add value to areas compared to those without them. This finding confirms that environmental factors are a significant

motivation for urban agriculture, as suggested by Boukharta et al. (2024), Codato et al. (2024), Kirby et al. (2021), and Yuan et al. (2022). These results further confirm that environmental awareness often serves as an entry point for civic participation in urban sustainability, particularly when economic incentives are weak (Amato & Simonetti, 2021). Further studies are needed to determine if this environmental focus leads to gentrification externalities, as suggested by Yuan et al. (2022).

The dominance of government programs and environmental motivations suggests that urban agriculture in Semarang is not yet a strong driver of economic empowerment, which limits its direct contribution to SDGs 1 and 8. However, its role in greening the city and promoting local food production aligns with SDG 2, offering a foundation upon which more economically viable models could be developed. This pattern reflects what Raja (2024) termed "policy-induced participation," where local governments serve as catalysts for sustaining collective farming initiatives in urban contexts.

Meanwhile, participants also cited social reasons for engaging in community gardening, as these activities strengthen relationships among residents. Respondent 2 shared the following: "Every second Saturday or Sunday, we work together to clean the neighborhood. The activity usually ends with a meal together, often using vegetables grown in our community garden. This fosters a more harmonious community." (Interview, April 9, 2024).

In addition to fostering relationships among residents, participants also frequently use proceeds from sales to help neighbors in need, such as those who are ill or in debt, even if they are not members of the farmer group. This illustrates another social benefit of community gardening.

The data in Figure 9 can be further analyzed to determine the hierarchy of the primary reasons for participants engaging in community gardening, as shown in Figure 10 below:

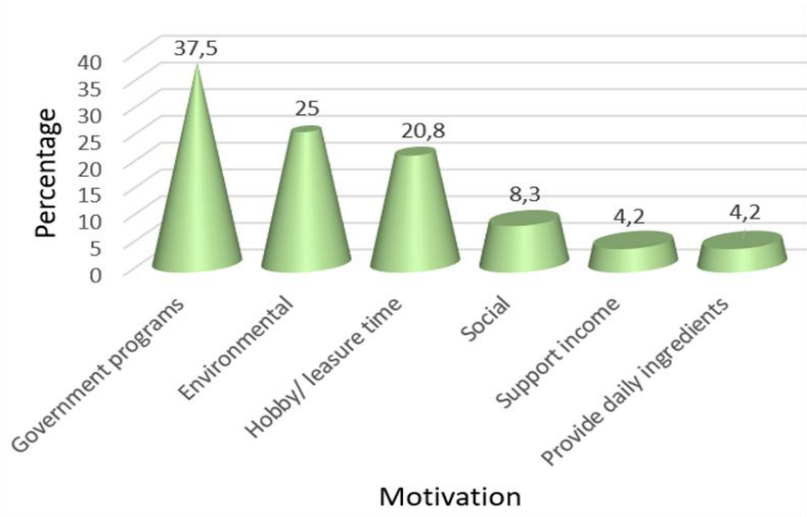

Figure 10. Participants' highest to lowest primary motivation
Source: Data Processed, 2024

As Figure 10 indicates, economic and food security-related reasons (increasing income and providing daily kitchen ingredients) are actually the last two reasons participants cite for engaging in community gardening. Surprisingly, the primary motivation for participants is that community gardening is a government program. This finding has not been prominently revealed in other studies, which generally emphasize economic, environmental, or social factors as primary drivers. This diverges from the dominant narrative in urban agriculture literature, which typically frames participation as a bottom-up response to economic precarity or food

insecurity. In contrast, the findings of this study reveal a strong top-down dynamic, where state-led initiatives shape community engagement more than personal or collective necessity.

This constitutes a novel contribution to the discourse on urban agriculture, especially in the Global South context, by highlighting the role of government policy as a primary and enduring driver of community gardening sustainability. It also implies that future programs should strike a balance between state facilitation and community autonomy to avoid excessive dependency, thereby promoting self-sustaining urban agriculture ecosystems (Kanosvamhira, 2024).

CONCLUSION

Despite the approaching 5-year deadline for achieving the Sustainable Development Goals (SDGs), which were agreed upon by all UN member states, the world continues to grapple with significant economic and social challenges, including food insecurity, poverty, and unemployment. In this context, promoting urban agriculture within communities is a promising initiative, as it has demonstrated potential in various countries for increasing income, reducing poverty, and enhancing food security among urban agricultural practitioners. However, this study reveals that, from an economic perspective, community gardens—an embodiment of urban agriculture—tend to operate at a loss. This situation raises concerns about the sustainability of community garden initiatives, as their viability is largely contingent upon their economic sustainability.

The research further identifies the hierarchical motivations for individuals to persist in community gardening: (1) participation in a government program; (2) environmental concerns; (3) personal hobbies or leisure activities; (4) social reasons; and (5) economic incentives.

Therefore, while urban agriculture is theoretically an economic sector capable of increasing incomes, reducing unemployment, and alleviating poverty, this study offers a complementary perspective: not all forms of urban agriculture yield positive economic outcomes. Specifically, within the context of Semarang City, community gardens are found to be financially unviable.

The practical implications of these findings suggest that (1) the objectives of community garden programs should shift away from primarily economic and social aspirations, and (2) the government must play an active and consistent role as the primary driver and supporter of the community garden initiative to ensure its sustainability.

Urban agriculture encompasses a range of forms, including urban fields, community gardens, school gardens, rooftop gardens, and greenhouses. Future research should consider exploring these alternative forms beyond community gardens.

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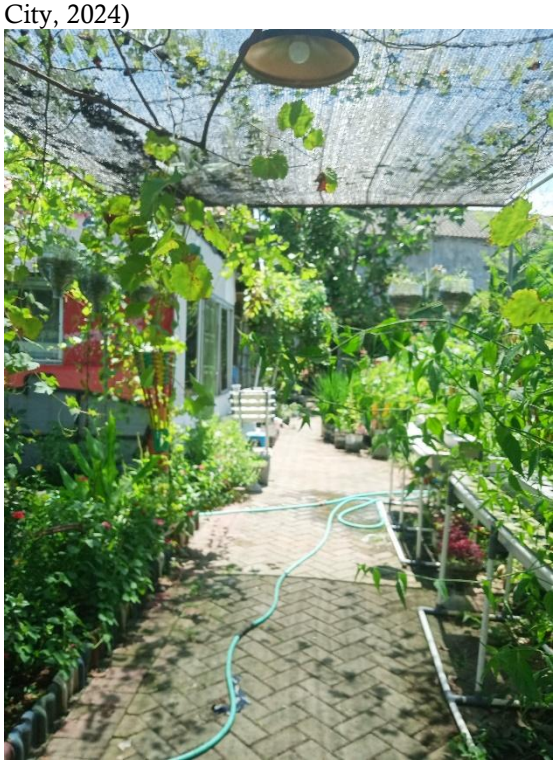
APPENDIX

Appendix 1. Field documentation: Community garden of Cluster A farmer group (Semarang City, 2024)



Appendix 2. Field documentation: Community garden of Cluster D farmer group (Semarang City, 2024)