Pangripta Jurnal Ilmiah Kajian Perencanaan Pembangunan
https://jurnalpangriptav3.malangkota.go.id/pangripta

E-ISSN: 2615-5702, P-ISSN: 2620-5785
Vol. 8, No. 2, page 213- 230

Evaluating Social and Functional Effectiveness of Community Agroparks: A Multidimensional Approach from Malang City

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Abstract

Community agroparks represent an innovative approach to urban green space management, combining ecological services, social interaction, aesthetic value, and local economic participation. This study adopts a multidimensional analytical approach to evaluate their effectiveness in Malang City, Indonesia. Using Multidimensional Scaling (MDS), agroparks were classified into four typologies based on facility provision, green coverage, and community activity levels. A Service Quality Gap Analysis was then applied to assess perceived performance across ecological, socio-cultural, aesthetic, and economic dimensions. Findings reveal that community-managed agroparks outperform government-managed ones in socio-cultural engagement, but still face gaps in aesthetic quality and income-generating potential. The study contributes to urban sustainability research by operationalizing a combined typology–gap framework to measure agropark performance and offering targeted recommendations to improve infrastructure design, participatory programming, and local economic integration. These insights support policy directions aimed at enhancing the multifunctionality of agroparks and advancing SDG 11 (Sustainable Cities and Communities).

Article Info

Keywords:
Urban Agriculture,
Community Agropark,
Social Performance,
Typology Analysis,
Sustainable Cities

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Received: 27-08-2025
Revised: 01-09-2025
Accepted: 05-09-2025
Published: 22-09-2025

1. Introduction

Urbanization has accelerated rapidly across Southeast Asia, generating both significant opportunities and complex challenges for cities aiming to balance economic development with environmental protection and social equity. As urban land becomes increasingly contested and green space per capita declines, cities face growing pressure to address environmental degradation, social disconnection, and the lack of inclusive recreational infrastructure (Pauleit et al., 2021; Said S Mansor, 2011). In response, the concept of multifunctional green infrastructure has gained traction, offering integrated solutions that deliver ecological, social, and economic benefits. Among the emerging practices, community agroparks—green spaces managed by local governments or communities that integrate agriculture, leisure, and education—have been highlighted as a promising tool for urban resilience and sustainable development (Siehr, Sun, S Aranda Nucamendi, 2022).

Community agroparks serve as hybrid spaces that fulfill multiple urban needs. Environmentally, they contribute to ecosystem services such as improved air quality, microclimate regulation, and stormwater absorption (Lovell S Taylor, 2013). Socially, they foster interaction, knowledge sharing, and intergenerational learning, reinforcing community ties and offering platforms for cultural expression and social inclusion (Fernández-Salido et al., 2025). Economically, agroparks can support local livelihoods through urban agriculture cooperatives, farmers' markets, and community-based tourism initiatives. In Southeast Asia, the adoption of such multifunctional green spaces is increasingly recognized as a strategy to

address urban vulnerabilities, reduce land-use conflict, and adapt to climate risks such as flooding and heat stress (Tun et al., 2024; Daudey S Matsumoto, 2017).

Despite their potential, the implementation of community agroparks faces institutional and planning barriers, including siloed governance, lack of long-term funding, and limited community participation in design processes (Pauleit et al., 2021). Nevertheless, the growing body of evidence suggests that when integrated into broader green infrastructure and resilience strategies, agroparks can serve as catalysts for inclusive and sustainable urban transformation.

In Indonesia, the rapid growth of urban farming movements and local government initiatives has resulted in the proliferation of agroparks, particularly in secondary cities like Malang, which is known for its horticultural productivity and growing urban population. However, despite their popularity, there is limited evidence on whether these agroparks effectively fulfill their intended roles. Existing studies often focus on infrastructure availability—such as green coverage or facility count—rather than on the outcomes that matter most for communities, including social cohesion, educational value, and income generation potential. As noted by Perangin Angin S Anggreni (2023), while visitors positively perceive facilities and attractions at agro-tourism sites like Malini Agropark in Bali, efforts to evaluate deeper community outcomes remain sparse.

Kurniawan et al. (2019) further emphasize that the development of agropolitan areas in Indonesia frequently fails to achieve its social objectives due to inadequate attention to local capacities, especially in terms of human capital development, community engagement, and profit-sharing mechanisms. Similarly, Widijastuti et al. (2013) found that although agropolitan programs can enhance product quality and market access for farmers, these benefits are often unevenly distributed, with smallholders facing persistent challenges in accessing finance and negotiating with buyers.

These gaps suggest the need for more holistic evaluations of urban agroparks that incorporate multidimensional indicators of success. Metrics should go beyond land productivity to include levels of citizen participation, perceived community benefits, and the inclusivity of program design. Without this broader lens, there is a risk that agroparks become merely aesthetic or economic zones without achieving their transformative potential for urban social resilience and sustainable livelihoods. Figure 1 illustrates the conceptual model adopted in this study, positioning agroparks as nodes where ecological, social, aesthetic, and economic functions intersect. Evaluating performance across these four dimensions is essential for understanding whether agroparks achieve their intended multifunctionality.

Figure 1. Conceptual Model of Community Agropark Multifunctionality

A growing body of literature highlights the need for multi-dimensional assessment frameworks to capture the complexity of green space performance. Alipour et al. (2011) and Zhang (2021) emphasize that descriptive mapping combined with participatory evaluation methods allows researchers to uncover both objective and perceived outcomes. Furthermore,

service quality gap analysis has proven effective in diagnosing mismatches between public expectations and actual service delivery in urban green space management (Pereira et al., 2024). Yet, few studies have combined a typology-based spatial classification with perceptual gap measurement, particularly in the context of community-managed agroparks in Indonesia.

Previous research provides an important foundation for understanding the effectiveness of green open spaces and agroparks. Gavinho (2016) emphasized that ecological and aesthetic dimensions—such as green coverage and landscape quality—are positively correlated with visitor satisfaction, underscoring the role of visual appeal and environmental quality in shaping a pleasant user experience. From a social perspective, Mbaiwa (2010) found that community involvement is a key determinant of the long-term sustainability of urban park programs. Community participation not only fosters a sense of ownership but also extends the lifecycle and maintenance of public facilities.

In the specific context of agrotourism, Ihsan and Gunawan (2024) demonstrated that converting agricultural land into tourism areas can slow the rate of land conversion while offering visitors meaningful educational experiences—an insight that is particularly relevant for cities like Malang facing increasing urbanization pressures. Furthermore, Pereira et al. (2024) applied service quality gap analysis to identify mismatches between public expectations of urban parks and the actual services provided, highlighting the value of perception-based evaluation. Taken together, these studies show that previous research has tended to emphasize ecological and recreational dimensions, while economic and participatory outcomes remain relatively underexplored. This gap highlights the need for a multidimensional approach that not only maps facility provision but also assesses the extent to which public spaces such as agroparks deliver balanced ecological, social, aesthetic, and economic impacts.

This evidence points to a critical gap in the literature: there is still insufficient knowledge about how different types of agroparks perform across multiple functional dimensions and whether they meet the expectations of local communities. This gap is particularly relevant in Malang City, where agroparks have been positioned as tools for promoting urban food security, environmental education, and citizen participation. Without systematic evaluation, there is a risk that investments in agropark development may underdeliver in terms of social and economic impact.

Accordingly, this study sets out to answer the following research questions:

1. How can community agroparks in Malang City be classified into meaningful typologies based on their physical and functional characteristics?
2. To what extent do these agroparks meet community expectations across ecological, socio-cultural, aesthetic, and economic dimensions?
3. Which dimensions show the largest performance gaps, and what recommendations can be made to improve their multifunctionality?

This research adopts a descriptive–evaluative approach integrating Multidimensional Scaling (MDS) for typology development and Service Quality Gap Analysis for outcome evaluation. By combining objective spatial data with subjective community perceptions, this study contributes to a more holistic understanding of urban agropark performance and provides actionable insights for policymakers and community managers to design greener, more inclusive, and socially impactful urban spaces.

2. Methods

This study employed a descriptive–evaluative research design to assess the social and functional effectiveness of community agroparks in Malang City. This methodological approach aligns with best practices for evaluating multifunctional green spaces, enabling both objective classification based on observable features and evaluative assessment from the user perspective (Kaczynski et al., 2008). Data collection occurred in two stages. First, field observations documented the physical characteristics of selected agroparks such as green coverage, facility availability, spatial layout, and the intensity of community activity following a protocol similar to structured audits of urban parks (Giles-Corti et al., 2005). Observational checklists were used to ensure consistency across sites and to yield comparable data for multivariate analysis (Veitch et al., 2013).

Following observations, a structured questionnaire survey was administered to 100

respondents from diverse demographic backgrounds, including local residents, frequent visitors, and community group members involved in agropark initiatives. This inclusive sampling strategy is consistent with participatory urban green space studies that emphasize community-centered evaluation (Lafortezza et al., 2009). The survey assessed expectations and perceptions of agropark performance across four dimensions— ecological, socio-cultural, aesthetic, and economic using a five-point Likert scale, a standard tool for measuring service quality in public amenities (Parasuraman et al., 1988).

Data analysis followed a two-step approach. First, Multidimensional Scaling (MDS) was applied to the observational data to produce a spatial representation of agroparks by similarity profiles, facilitating a typology of sites with shared features and activity patterns (Hahs S McDonnell, 2006). Second, SERVQUAL analysis was conducted to evaluate the performance gap between perceived service (P) and user expectations (E) in each dimension, where negative scores indicate underperformance (Ismail et al., 2016). To confirm the internal reliability of the instrument, Cronbach's alpha was computed and yielded values above 0.70 across all dimensions confirming acceptable internal consistency for social science research (Tavakol S Dennick, 2011).

The MDS results were presented through a two-dimensional perceptual map to assist in cluster interpretation and typology formation, while gap scores were analyzed by typology group to identify critical areas of underperformance. Ethical standards were rigorously upheld throughout the study: all respondents were fully informed of the study's aims, their anonymity was protected, and participation was strictly voluntary— aligning with ethical research norms in public space studies (Israel et al., 1998). A methodological flowchart was developed to illustrate the overall research process, as shown in Figure 2.

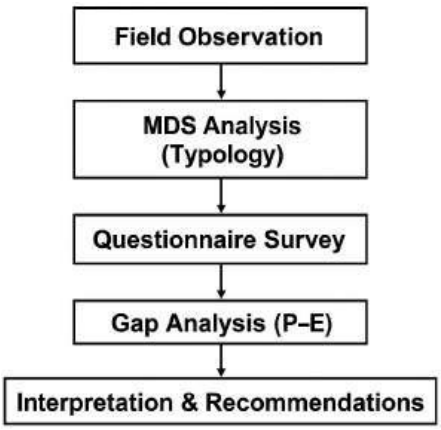

Figure 2. Research Methodology Flowchart

3. Results asnd Discussion

Result

The analysis provides an in-depth picture of how community agroparks in Malang City perform across ecological, socio-cultural, aesthetic, and economic dimensions, highlighting both best practices and critical gaps. The integration of Multidimensional Scaling (MDS) and Service Quality Gap Analysis generated a robust classification of agroparks and revealed meaningful differences in their effectiveness.

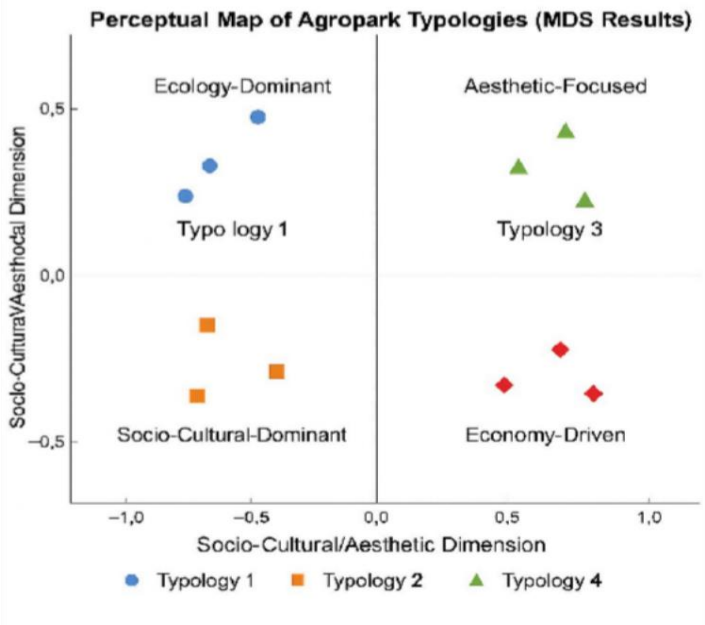

Figure 3. Perceptual Map of Agropark Typologies (MDS Results)

The MDS analysis produced a two-dimensional perceptual map (Figure 3), which clustered agroparks into four distinct typologies based on similarity profiles derived from green coverage, facility provision, and activity intensity. Typology 1 represented ecology-dominant agroparks, characterized by high vegetation cover and strong ecological services but relatively limited programming. Typology 2 reflected community-driven sites, where local participation and social activities were most pronounced. Typology 3 corresponded to government-managed parks with high aesthetic appeal but limited economic activation. Typology 4 represented fully integrated agroparks with balanced attributes across all observed variables, standing out as the most multifunctional category.

The Service Quality Gap Analysis provided further insights into how each typology meets or falls short of community expectations. Table 2 summarizes the gap scores across the four dimensions, while Figure 4 visualizes the results in a radar chart for clearer comparison. Typology 4 consistently recorded positive or near-zero gaps, indicating that it effectively meets visitor expectations across most dimensions. By contrast, Typologies 1 and 3 exhibited the largest negative gaps, particularly in economic function (−0.52 and −0.50 respectively), suggesting that opportunities for income generation and local entrepreneurship remain underdeveloped.

Cluster analysis revealed that Typology 1 represented agroparks with high ecological quality and green coverage but limited community programming. Typology 2 consisted of community- driven agroparks that exhibited strong socio-cultural programming but moderate infrastructure. Typology 3 was characterized by government-managed parks with high aesthetic appeal but lower levels of economic activity. Typology 4 represented fully integrated agroparks with balanced performance across all dimensions.

Table 2. Gap Analysis of Agropark Functions

Typology	Ecological (P–E)	Socio-Cultural (P–E)	Aesthetic (P–E)	Economic (P–E)
Typology 1	-0.12	-0.38	-0.45	-0.52
Typology 2	-0.08	-0.15	-0.41	-0.47
Typology 3	-0.20	-0.28	-0.12	-0.50
Typology 4	+0.05	+0.02	-0.09	-0.15

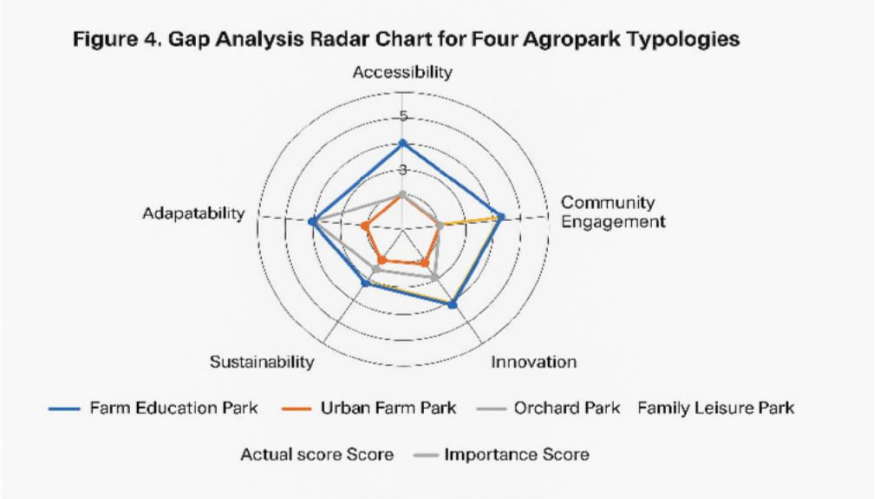

Figure 4. Gap Analysis Radar Chart for Four Agropark Typologies

Beyond the quantitative scores, a critical interpretation of these results provides further insight into the structural and governance challenges faced by community agroparks. The balanced performance of Typology 4 is particularly noteworthy because it demonstrates that agroparks can simultaneously deliver ecological protection, social engagement, visual quality, and economic vitality. Rather than being in competition, these dimensions appear to reinforce each other: parks that invest in well-designed landscapes and interpretive features tend to attract more visitors, which in turn increases revenue and strengthens community pride. This finding echoes Pereira et al. (2024), who argue that high-quality infrastructure and aesthetics are key drivers of dwell time and local spending.

In contrast, the substantial gaps observed in Typologies 1 and 3, especially in the economic dimension, reveal a structural weakness that could threaten long-term sustainability. Parks with poor revenue generation capacity are at risk of becoming dependent on external subsidies, which can undermine community ownership and reduce incentives for innovation. Moreover, the lack of diversified income streams means that these parks are unable to reinvest in maintenance and program development, potentially leading to a cycle of decline. These findings underline the urgency of developing clear business models and value-capture mechanisms, such as farmers' markets, agri-education packages, or partnerships with local cafés, to convert visitor footfall into meaningful economic benefit for the community.

Typology 2 provides a different kind of lesson: despite having modest infrastructure, these agroparks excel in mobilizing community participation. This suggests that social capital and grassroots leadership can partially compensate for resource constraints, a finding consistent with Mbaiwa's (2010) assertion that participation is the cornerstone of sustainable community- based tourism. For policymakers operating under tight budget conditions, Typology 2 offers a replicable, low-cost pathway for achieving social impact through community empowerment rather than purely infrastructure-driven solutions.

Qualitative feedback from respondents provided additional nuance to the quantitative findings. Several participants praised the educational and participatory programs available at community-led agroparks, stating that such activities strengthened their connection to local food systems. Others noted the lack of shaded seating, insufficient thematic landscaping, and limited marketing of local produce, which corroborates the negative gap scores in aesthetic and economic dimensions. These insights indicate that while agroparks succeed in fostering ecological awareness and social interaction, their potential as income-generating and visually engaging spaces remains underutilized.

Respondents frequently mentioned the need for improved seating areas, shaded spaces, and thematic landscaping to enhance the aesthetic dimension, corroborating the

negative gap scores observed. Similarly, several respondents suggested developing regular farmers' markets, culinary events, and cooperative-based entrepreneurship programs to close the economic function gap.

Importantly, the results show that ecological and socio-cultural functions have the narrowest gaps across all typologies, confirming that agroparks are contributing to urban greening and community engagement goals. This performance reinforces the idea that agroparks serve as critical nodes of social-ecological infrastructure, though their impact could be magnified through targeted aesthetic enhancements, structured entrepreneurship programs, and closer collaboration with local governments and cooperatives.

Discussion

The findings from this study provide new empirical insights into the performance of community agroparks in Malang City, revealing both the promise and the challenges of developing multifunctional urban green spaces. The typology derived from the Multidimensional Scaling (MDS) analysis confirms that agroparks are not a homogeneous phenomenon; rather, they fall into four distinct groups, each characterized by a unique configuration of facilities, spatial design, and programmatic focus. This heterogeneity is an important empirical contribution because it highlights that not all agroparks deliver the same type of value to urban residents. Typology 4, which demonstrated balanced performance across ecological, socio-cultural, aesthetic, and economic dimensions, may serve as a benchmark or "best practice" model for future agropark development. The success of this typology underscores the argument advanced by Korkou, Tarigan, and Hanslin (2025), who propose that multifunctional green infrastructure, when properly planned and implemented, can simultaneously address multiple urban needs— including environmental protection, social well-being, and local economic resilience—while reducing land-use conflict in rapidly urbanizing areas.

The importance of identifying typologies is twofold. First, it provides city planners and policymakers with a clear sense of which types of agroparks are performing well and which are lagging, enabling a more nuanced allocation of resources and interventions. Second, it demonstrates that the concept of a "community agropark" is not monolithic: some parks are ecologically rich but socially underutilized, others are socially vibrant but lack economic activation, while a small fraction achieve balance across all dimensions. This insight suggests that municipal strategies must be tailored rather than adopting a "one-size-fits-all" approach. For instance, ecology-dominant parks (Typology 1) might benefit most from programming that encourages public use and engagement, whereas aesthetically focused government-managed parks (Typology 3) may need initiatives that stimulate entrepreneurship and informal markets. Such differentiated strategies are consistent with the principles of adaptive co-management, where governance responses are matched to the ecological and social characteristics of the system being managed.

Despite the promise shown by Typology 4, the majority of agroparks exhibited notable performance gaps, particularly in the aesthetic and economic dimensions. The negative aesthetic scores reported for Typologies 1, 2, and 3 suggest that these spaces are not meeting visitor expectations with respect to visual appeal, thematic landscaping, seating arrangements, and general ambience. This finding is critical because, as Chen et al. (2009) have noted, aesthetic quality is not merely an ornamental attribute but a determinant of user satisfaction and frequency of visits. Their work indicates that aesthetic quality encompasses multiple sensory dimensions—visual cues such as plant diversity and seasonal color, auditory comfort through soundscaping and noise buffering, and tactile qualities associated with materials and surfaces. When any of these elements is lacking, the visitor experience may be diminished, potentially reducing repeat visitation and community ownership of the space.

Furthermore, Munteanu and Andronovici (2022) emphasize that well-designed, inclusive, and visually appealing community spaces foster intergenerational interaction and sustained public use. The lack of adequate shading, comfortable resting areas, and interpretive signage in several of the surveyed agroparks likely inhibits elderly visitors, parents with children, and those seeking longer recreational stays from fully enjoying the space. This has broader implications for social sustainability because public green spaces are among the few venues where diverse demographic groups can interact in a shared environment, thereby strengthening community bonds. If aesthetic or functional discomfort limits usage, the potential for agroparks to contribute to social cohesion is compromised.

The economic function emerged as another critical area where performance gaps were consistently observed across almost all typologies except Typology 4. The relative scarcity of farmers' markets, cooperative-based retail points, farm-to-table dining events, and other entrepreneurial opportunities suggests that agroparks remain underleveraged as drivers of local economic activity. This is a missed opportunity, as research has shown that the multifunctionality of green infrastructure is maximized when ecological, social, and economic services are jointly addressed through deliberate planning and cross-sectoral partnerships (Ali et al., 2021; Czembrowski et al., 2019). Economic activation not only increases the financial sustainability of agroparks—by generating revenue streams that can be reinvested in maintenance and programming—but also provides livelihoods for local farmers, artisans, and food entrepreneurs.

The integration of economic activities can take multiple forms, including periodic farmers' markets that sell locally grown produce, small-scale educational tourism packages that generate income for guides and educators, and special events such as harvest festivals that attract both local residents and tourists. These initiatives can contribute to local circular economies, reduce food miles, and create pride of place among community members. The absence of such programs in many of the surveyed agroparks suggests that local governments and park managers may be focusing primarily on the ecological and recreational functions of these spaces, potentially due to limited budgets, a lack of entrepreneurial partnerships, or regulatory constraints. Addressing this gap requires policy innovation, such as streamlining permits for community markets, providing micro-grants for agropark-based startups, or incentivizing public–private partnerships to co-create economic programming.

Another layer of interpretation relates to the synergy between aesthetic and economic functions. When agroparks invest in aesthetic improvements—such as thematic landscaping, comfortable seating, and cultural design motifs—they often create a more inviting environment that attracts larger crowds, thereby increasing the potential customer base for economic activities. This mutually reinforcing relationship has been documented in urban design literature, where aesthetically appealing public spaces are associated with higher footfall and greater willingness to spend time and money within the area (Gavinho, 2016). In other words, improving the "look and feel" of agroparks may not only enhance user satisfaction but also unlock new economic potential.

From a social equity perspective, the findings raise important considerations. If aesthetic improvements and economic programs are concentrated only in select parks (such as those in Typology 4), there is a risk of uneven distribution of benefits, which could exacerbate spatial inequalities within the city. Residents living near lower-performing agroparks might receive fewer social, cultural, and economic benefits compared to those near high-performing sites. This calls for a more balanced approach to investment across the agropark network, ensuring that even smaller or less well-resourced parks receive targeted support to meet minimum standards of quality. Such equity considerations are consistent with the frameworks advanced by Silva (2014), who argues that social sustainability indicators must account for accessibility, inclusiveness, and fairness in the distribution of public amenities.

The results also resonate with the growing body of work that frames urban green spaces as "social–ecological systems." In this perspective, agroparks are not merely patches of greenery but complex systems where human and ecological components interact dynamically. When one dimension underperforms—such as aesthetics or economic function the resilience of the whole system may be compromised. For example, if visitors find the space unattractive and stop coming, community participation declines, social learning opportunities are reduced, and volunteer-based maintenance efforts may wane, leading to ecological neglect. Conversely, when parks are vibrant, visually appealing, and economically active, they tend to attract more users, increase surveillance through "eyes on the park," and generate more resources for upkeep, thereby creating a virtuous cycle of sustainability.

These insights have practical implications for urban planners and managers in Malang City. First, interventions should focus on closing the aesthetic gap by providing shaded rest areas, diverse plantings that showcase seasonal variety, and interpretive signage that enhances the educational value of visits. Such improvements would directly address the concerns expressed by visitors and align with recommendations from Chen et al. (2009) and Munteanu & Andronovici (2022) for creating inclusive, multisensory environments. Second, economic activation strategies must be developed, potentially through co-design processes involving local communities, cooperatives, and small businesses. Ali et al. (2021) argue that co-production of green infrastructure functions leads to higher levels of legitimacy and sustainability, as stakeholders become co-investors in the success of the space.

On the other hand, the relatively strong performance in ecological and socio-cultural functions is a notable strength and an important differentiator of community agroparks compared to conventional urban parks. The consistently positive or near-zero gap scores in these dimensions suggest that agroparks are fulfilling their foundational roles as green infrastructure, contributing to urban cooling, carbon sequestration, biodiversity support, and improved microclimates. These ecological functions are not just incidental but integral to the sustainability of cities under pressure from urban heat islands and air pollution. In line with the observations of Bressane et al. (2024), community engagement in the management of these green spaces has a measurable impact on access and equity, reducing socio-environmental inequalities by ensuring that even low-income and peripheral neighborhoods can benefit from ecosystem services.

Community-led agroparks (Typology 2) were particularly effective in fostering participation and social interaction, a finding that resonates with participatory planning literature emphasizing the importance of inclusive governance models. The presence of regular volunteer programs, community gardening initiatives, and local festivals at these sites indicates that they serve as active "social nodes" rather than passive green backdrops. This aligns with the growing body of evidence that participatory governance strengthens community ownership, ensures continuity of use, and enhances environmental stewardship. By creating a sense of belonging and collective responsibility, participatory processes encourage users to act as co-managers, which not only reduces vandalism and maintenance costs but also increases the adaptive capacity of the space over time. These findings reinforce the idea that agroparks can be leveraged as platforms for environmental education and collective learning. When communities are actively involved in composting workshops, seed exchange programs, and educational tours, they develop stronger ecological literacy and pro-environmental behaviors. This is significant because behavioral change at the community level is often cited as a prerequisite for achieving broader sustainability targets, including the Sustainable Development Goals (SDGs). Specifically, SDG 11 (Sustainable Cities and Communities) calls for universal access to green and public spaces, while SDG 12 (Responsible Consumption and Production) emphasizes sustainable resource use. Community agroparks, by connecting residents with the source of their food and encouraging sustainable consumption habits, can play a catalytic role in advancing both goals.

Another key implication of this study is the need for differentiated management strategies tailored to the specific characteristics of each agropark typology. As the results indicate, government-managed parks (Typology 3), while aesthetically superior, tend to underperform economically. This imbalance suggests that such parks could benefit from integrating more community-based programs and entrepreneurial initiatives to activate underused spaces and create inclusive economic opportunities. Examples could include hosting cooperative-run weekend markets, pop-up stalls for local artisans, or farm-to-table culinary events that encourage microenterprise participation. These activities would not only boost the local economy but also increase visitor dwell time and create additional revenue streams that can be reinvested into park maintenance and improvements.

Conversely, community-driven agroparks—although strong in socio-cultural engagement— may face challenges related to infrastructure quality, landscaping, and the provision of basic amenities. This finding underscores the importance of municipal support in providing technical assistance, funding, and design expertise to help these spaces achieve higher aesthetic standards. Providing access to professional landscape architects, offering grants for infrastructure upgrades, and facilitating partnerships with local universities could help community-led parks enhance their visual appeal without compromising their grassroots character.

Such a targeted and differentiated approach aligns closely with adaptive co-management principles, which emphasize iterative learning, shared decision-making, and power-sharing between state and community actors. Adaptive co-management recognizes that local knowledge is crucial for managing complex social-ecological systems, but it must be complemented by institutional support to overcome resource constraints. This co-management framework, as noted by Wei (2017), enables stakeholders to experiment with solutions, monitor outcomes, and adjust strategies in a flexible and collaborative manner. Moreover, multifunctionality frameworks argue that maximizing the benefits of green infrastructure requires a systemic perspective that accounts for trade-offs and synergies among ecological, social, aesthetic, and economic functions (Korkou, Tarigan, & Hanslin, 2023). By aligning management interventions with the unique strengths and weaknesses of each typology, Malang City can ensure that the agropark network as a whole delivers a balanced portfolio of benefits.

The need for such differentiated strategies also ties into broader equity considerations. Without deliberate policy design, there is a risk that only flagship parks—those already well-resourced—will continue to improve, leaving smaller, community-managed sites under-supported. This could exacerbate existing disparities in access to quality green space. To mitigate this, municipal authorities should adopt a network-wide perspective, establishing minimum quality standards for all agroparks and prioritizing investment in those with the greatest performance gaps. Performance dashboards that track indicators such as participation rates, biodiversity indices, and economic revenue could provide an evidence base for allocating resources transparently and equitably.

Another dimension that emerges from the findings is the role of partnerships and multi-actor collaboration. Creating sustainable agroparks is not solely the responsibility of municipal governments. Private sector actors, non-governmental organizations, educational institutions, and local cooperatives can play complementary roles in programming, funding, and knowledge exchange. For example, universities can conduct regular monitoring of ecological indicators, local businesses can sponsor events or infrastructure upgrades, and NGOs can facilitate community engagement processes. Such collaborative governance models not only diversify the resource base but also increase resilience by reducing dependence on a single funding source.

From a policy perspective, the results call for a shift from a purely infrastructure-centric approach to a more programmatic and participatory model of green space management. Building more agroparks is not enough; what matters is ensuring that they are vibrant, inclusive, and economically viable. This implies integrating agropark planning into broader urban development strategies, linking them to food security programs, climate resilience plans, and cultural tourism initiatives. Embedding agroparks within these policy frameworks can help secure stable funding streams and institutional support, making them less vulnerable to changes in political priorities.

Interpreting these results from a regional development lens reveals that community agroparks can function as more than recreational amenities; they can be strategic instruments for spatial equity, food system resilience, and local economic activation. In a rapidly urbanizing city like Malang, where agricultural land is under constant pressure from real estate development, the ability of agroparks to simultaneously conserve green space and generate livelihoods represents a powerful tool for managing peri-urban transitions.

First, the strong ecological performance of most agroparks indicates that they contribute meaningfully to ecosystem services such as cooling, biodiversity protection, and stormwater management. When distributed equitably across urban and peri-urban areas, these ecological nodes form a green infrastructure network that supports climate adaptation and mitigates heat- island effects. This aligns with Daudey & Matsumoto's (2017) call for integrating green infrastructure into local resilience strategies to address the vulnerabilities of fast-growing Southeast Asian cities.

Second, the social engagement observed in community-led agroparks illustrates how these spaces can strengthen human and social capital. By hosting volunteer programs, educational workshops, and seasonal events, they nurture a culture of collective stewardship and environmental literacy. Such participatory processes build trust between citizens and local governments, a cornerstone for successful co-management and inclusive governance (Mbaiwa, 2010). Regional development agencies could harness this momentum by funding capacity-building initiatives—such as cooperative management training, digital marketing skills, and agro-tourism product innovation—that empower communities to become long-term co-managers rather than passive beneficiaries.

Third, the aesthetic and economic gaps revealed in most typologies point to specific areas where strategic investment could unlock multiplier effects. Enhancing visual quality through thematic landscaping and interpretive design not only improves visitor satisfaction but also increases dwell time and spending potential, reinforcing local economies. Similarly, activating underutilized spaces for farmers' markets, culinary festivals, and cooperative-run kiosks creates microeconomic ecosystems that benefit producers and consumers alike. This resonates with Ali et al. (2021), who argue that the socio-economic impact of green infrastructure is maximized when programming deliberately links ecological benefits to entrepreneurial opportunities.

Finally, the results suggest that an equity-focused approach is essential to prevent the concentration of benefits in only the most resourced parks. Performance dashboards and targeted funding mechanisms could ensure that parks with the largest gaps receive priority interventions, reducing spatial inequality and extending the benefits of green infrastructure to underserved neighborhoods. This approach supports SDG 11 on inclusive and sustainable cities, ensuring that agroparks contribute to balanced urban development rather than reinforcing existing disparities.

Interpreting the results through a regional development lens reveals that community agroparks in Malang City hold far-reaching significance that transcends their immediate function as leisure or educational spaces. They emerge as strategic infrastructure capable of addressing multiple policy priorities simultaneously—spatial equity, local economic revitalization, ecological resilience, and social cohesion—if supported by coordinated planning and investment. In a rapidly urbanizing context where agricultural land is under constant pressure from real estate development, agroparks offer a rare opportunity to conserve peri-urban landscapes while providing meaningful livelihoods for rural and semi-rural communities. This dual role positions them as vital instruments for managing peri-urban transitions, balancing the tensions between growth and sustainability.

Green Infrastructure and Climate Resilience

Such ecological functions reinforce the potential of agroparks as critical nodes in the broader urban climate adaptation strategy. In Southeast Asia, green infrastructure— including urban wetlands, green roofs, and vegetated corridors—has been shown to reduce urban heat, improve flood resilience, and promote biodiversity (Sañudo- Fontaneda & Rosen, 2018). These ecosystem services, when strategically distributed, enhance not only ecological connectivity but also contribute to thermal comfort and improved public health outcomes (Kim, 2015).

Furthermore, integrating agroparks into the city's water management system can complement stormwater infrastructure by reducing runoff and improving infiltration capacity. Studies show that green stormwater infrastructure significantly contributes to urban flood mitigation, particularly in high-density urban areas vulnerable to extreme weather events (Xu et al., 2024). In addition, the implementation of decentralized green infrastructure systems in Southeast Asian cities has proven effective in increasing local resilience to both flooding and heatwaves (Kurniawan & Goh, 2024).

To maximize these benefits, urban planners in Malang could adopt a blue-green infrastructure framework that emphasizes nature-based solutions and multifunctionality. This would involve mapping underutilized spaces, prioritizing ecological corridors, and enhancing the capacity of existing agroparks to perform multiple roles—recreational, educational, ecological, and hydrological (Chandratreya, 2024)

Strengthening Social Capital and Human Capacity

This participatory approach aligns with the concept of "urban agroecological lighthouses," which serve not only as food production sites but also as civic spaces for social learning and cross-sectoral collaboration (Wit, 2014). When residents actively engage in agropark management—whether through guiding tours, organizing workshops, or maintaining gardens—they internalize ecological knowledge and civic responsibility. These forms of environmental stewardship cultivate a sense of place and contribute to long-term sustainability by embedding social learning into everyday urban life (Bendt et al., 2013).

Agroparks that succeed in this regard function as learning ecosystems, where knowledge exchange between generations and across backgrounds becomes possible. They foster a "social ecology" of cooperation, strengthening community bonds while also addressing broader sustainability goals. As Poulsen (2017) observed in the context of urban farming, community-oriented models that emphasize participation and inclusion often outperform commercial models in building resilient, equitable urban food systems. Embedding such practices within formal planning frameworks—through incentives, capacity-building, and inclusive governance—can multiply their impact and institutionalize social sustainability.

From a regional development perspective, this represents an opportunity to institutionalize capacity-building programs. Local governments and universities could collaborate to offer training in cooperative governance, agro-tourism entrepreneurship, event management, and digital marketing. By equipping community members with managerial and technical skills, these programs would ensure that the benefits of agroparks are not captured by external operators but remain rooted in the local economy. Over time, this approach could foster a generation of community leaders capable of co- managing tourism infrastructure, thereby reducing dependence on municipal budgets and creating a more resilient local governance ecosystem.

Furthermore, social capital has multiplier effects beyond the parks themselves. Residents who gain confidence and organizational experience through agropark participation often apply these skills in other areas—establishing cooperatives, initiating environmental campaigns, or engaging in village-level decision-making. Thus, the agroparks act as incubators for civic engagement, strengthening democratic participation and social cohesion at the regional scale.

Unlocking Aesthetic and Economic Potential

While ecological and social dimensions performed relatively well, the results revealed notable gaps in aesthetics and economic vitality, especially in Typologies 1 and 3. Rather than viewing these shortcomings as failures, they should be seen as strategic leverage points with the potential to boost overall park performance and community impact. Improving visual appeal through thematic landscaping, interpretive signage, and artistic installations can significantly enhance the visitor experience, extend dwell time, and foster emotional attachment to place. Studies have shown that well-designed aesthetic environments directly influence visitor satisfaction and increase the likelihood of repeat visits and spending [(Chen, Adimo, & Bao, 2009)].

Equally crucial is the activation of currently underutilized spaces for economic programming. Rotational events such as farmers' markets, culinary fairs, and weekend artisanal pop-ups can attract diverse user groups and generate income for local producers. This type of micro-enterprise fosters direct producer–consumer interaction, reducing intermediaries and enhancing local value retention. Evidence suggests that the economic value of green infrastructure is amplified when linked with inclusive entrepreneurship and localized supply chains [(Czembrowski et al., 2019); (Ali et al., 2021)].

Strategic investment in these areas could create a virtuous cycle: improved aesthetics attract more visitors, which increases spending, which generates funds for further upgrades and programming, thus raising the profile and competitiveness of the park. Over time, this cycle could transform underperforming parks into self-sustaining assets that no longer rely heavily on municipal subsidies.

The gap analysis also revealed disparities in performance and access across the agropark network, highlighting that certain subdistricts benefit from well-maintained and well-equipped parks, while others—often in lower-income or peripheral zones—remain underserved. This uneven distribution can deepen socio-spatial inequalities, depriving marginalized communities of essential opportunities for recreation, environmental learning, and micro-enterprise development. Research emphasizes that inequitable green infrastructure provision risks contributing to a phenomenon known as "green gentrification," where improvements primarily benefit already advantaged populations, potentially displacing vulnerable groups (Cucca & Thaler, 2023).

To mitigate such risks, future investments should be guided by an explicit equity framework. Cities are encouraged to implement performance monitoring systems that track ecological, social, aesthetic, and economic indicators across green spaces, allowing for data-driven allocation of funds to areas with the greatest needs (Grabowski, McPhearson, & Pickett, 2023). Integrating participatory budgeting processes can further ensure that residents have a meaningful voice in shaping interventions, thereby improving trust, transparency, and the long-term sustainability of park development (Rice & Hancock, 2016). This aligns with SDG 11's emphasis on inclusive, safe, and resilient cities, as well as Indonesia's National Urban Development Policy, which seeks to reduce inter-neighborhood disparities in access to public services.

Governance and Institutional Innovation

Underlying many of the performance gaps is a governance challenge: several parks lack clear management structures, resulting in irregular maintenance, fragmented programming, and underutilized marketing channels. Without defined roles, responsibilities, and coordination mechanisms, the long-term sustainability of agroparks remains uncertain. Establishing formal co-management agreements—involving municipal agencies, farmer cooperatives, local businesses, and civil society actors— could offer a more resilient institutional foundation. Such governance models foster shared ownership and resource pooling, enhancing adaptability and responsiveness to local needs [(Bramwell & Lane, 2011); (Hall, 2008)]. Beard (2019) notes that collaborative governance arrangements build mutual trust and support more inclusive, long-term problem-solving in community-based tourism systems.

At a broader level, the city could consider forming a Destination Management Organization (DMO) or a cooperative consortium to streamline cross-park coordination. A DMO would manage joint marketing, event scheduling, and strategic infrastructure investments, ensuring that parks are not managed in isolation but as part of an integrated urban green tourism system. This model is particularly effective in promoting destination coherence, brand consistency, and economies of scale [(Dredge & Jenkins, 2011); (Bianchi & Stephenson, 2013)]. Such institutions are increasingly viewed as essential for improving destination competitiveness in line with sustainability and governance objectives. This would help standardize quality, avoid duplication of efforts, and present a unified brand identity for Malang's agropark network. Such coordination could also facilitate joint funding applications to provincial or national development programs, unlocking larger pools of resources for infrastructure upgrades and capacity building.

Regional Integration and Long-Term Vision

Perhaps the most important implication of this study is the need to situate agroparks within a broader vision for peri-urban and regional development. Rather than treating them as isolated amenities, planners should view them as interconnected components of a green infrastructure corridor that links rural production zones with urban consumer markets. This concept aligns with the agropolitan development model, which emphasizes the integration of agricultural production and urban functions to stimulate balanced regional growth (Fazelbeygi, 2014).

Such a network could support short food supply chains, reducing food miles and promoting farm-to-table systems that enhance food security and benefit both producers and consumers (Chagwedera & Manhimanzi, 2024). Additionally, agroparks could be embedded in regional tourism circuits that include culinary destinations, creative industries, and cultural heritage sites. This approach reflects the multifunctional nature of peri-urban agriculture and its capacity to foster integrated rural–urban development (Yang, Cai, & Sliuzas, 2010) By positioning agroparks within this broader strategic vision, cities like Malang can diversify their tourism portfolios, enhance regional food systems, and drive inclusive economic growth across both urban and rural territories.

The long-term success of agroparks will depend on adaptive management and continuous monitoring. As urbanization advances, pressures on land, water, and labor markets will intensify. Without proactive planning, even the most successful parks risk being displaced or degraded. Embedding agroparks into the city's spatial plan, with legal protection and dedicated funding streams, will be essential to safeguard their role as public goods. Monitoring frameworks should track not only visitor numbers but also social and ecological outcomes, ensuring that the parks remain aligned with the principles of sustainability and community empowerment.

The evidence from this study suggests that community agroparks can be powerful levers for inclusive regional development if they are intentionally planned, equitably distributed, and adequately supported. They can cool cities, educate citizens, generate livelihoods, and foster civic pride—all within the same physical space. But to unlock this potential, policymakers must address gaps in aesthetic quality, economic activation, and governance coordination while preventing spatial inequalities from deepening.

If these challenges are met, Malang's agroparks could become not only local attractions but also model projects for other secondary cities in Indonesia seeking to balance urban expansion with rural sustainability. In doing so, they would contribute directly to achieving SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Production and Consumption), positioning Malang as a leader in innovative, community-centered urban–rural integration.

4. Conclusion

This study provides a comprehensive evaluation of community agroparks in Malang City, integrating objective typology classification with perceptual gap analysis to capture both the structural and experiential dimensions of performance. By identifying four distinct agropark typologies, the study demonstrates that multifunctionality is unevenly achieved across sites, with only Typology 4 meeting or exceeding expectations across ecological, socio-cultural,

aesthetic, and economic dimensions.

The findings contribute to urban sustainability scholarship by operationalizing a combined MDS–SERVQUAL framework, offering a replicable model for assessing multifunctional green spaces in other urban contexts. They also provide practical guidance for policymakers and community stakeholders by pinpointing where interventions are most urgently needed—namely in enhancing aesthetic quality through thematic landscaping and signage improvements, and in expanding economic opportunities through farmer cooperatives, weekend markets, and agro-education festivals.

Strengthening these dimensions will transform community agroparks from passive recreational spaces into dynamic socio-ecological infrastructures that generate inclusive economic benefits, foster cultural participation, and advance SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production). By bridging the gap between facility provision and community expectations, this study underscores the importance of designing agroparks not just as green amenities but as catalysts for resilient, socially cohesive, and economically vibrant cities.

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