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URBAN FARMING AND LIVELIHOOD RESILIENCE IN COASTAL CITIES: AN ECONOMIC AND ENVIRONMENTAL ACCOUNTING PERSPECTIVE FROM KENDARI

Abstract: Coastal cities in the Global South face increasing challenges in balancing economic development with environmental sustainability. Urban farming has emerged as a low-impact, community-based practice that can enhance livelihood resilience while contributing to green urban growth. However, its role is often overlooked in formal development accounting systems. This study adopts an economic and environmental accounting perspective to evaluate the dual role of urban farming in Kendari, a coastal city in Eastern Indonesia. Specifically, it assesses (1) the economic contribution of urban farming as part of the agriculture, forestry, and fisheries (AFF) sector to the city's Gross Domestic Regional Product (GDRP), and (2) environmental performance using indicators from the Asian Green City Index (AGCI), including energy consumption, CO_2 emissions, and air quality (NO_2, SO_2, PM_{10}). Data analysis reveals that the AFF sector, within which urban farming is embedded, ranks as the third-largest contributor to Kendari's GDRP (10.66%), yet its specific value remains unrecorded in sectoral financial reporting.

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Environmentally, Kendari's per capita energy consumption (1,121 kWh/person) and annual CO_2 emissions (316,560 tons) exceed AGCI benchmarks, although air quality remains within acceptable thresholds. By applying integrated accounting tools to quantify both economic output and ecological impact, this study demonstrates that urban farming can serve as both a productivity-enhancing and climate-mitigating urban asset. The findings underscore the need to institutionalize urban agriculture within local economic accounting frameworks and sustainability assessments to advance low-carbon development and support SDG implementation in coastal urban environments.

Keywords: peri-urban agriculture, adaptive capacity, urban coastal livelihoods, food system sustainability, informal economy

Introduction

The dual challenge of fostering economic growth while ensuring environmental sustainability has emerged as a central concern in global urban development discourse. This tension is particularly acute in coastal cities, where rapid urban expansion intersects with significant ecological vulnerabilities. Projections by the World Economic Forum (2019) estimate that more than 800 million people will reside in coastal urban areas by 2050, amplifying exposure to risks such as food insecurity, land degradation, and socio-economic inequality—particularly in Southeast Asia (Gu et al., 2021; Hooijer & Vernimmen, 2021). These cities also face compounding socio-environmental pressures, including land subsidence, sea-level rise, pollution, and infrastructure strain (Barragán & de-Andrés, 2015; Bott et al., 2021). Although global frameworks like the Sustainable Development Goals (SDGs) urge urban centers to pursue inclusive, resilient, and low-carbon pathways, economic growth remains the dominant priority in many local governance agendas—often at the expense of environmental stewardship and livelihood resilience (Ali et al., 2020; Hegazy, 2021).

In this context, urban farming emerges as a viable, low-impact practice that integrates food production into the urban fabric while addressing both economic and ecological challenges. It provides multiple co-benefits, including improving food access, diversifying household income, enhancing green spaces, and reducing climate vulnerability (Giyarsih et al., 2024; Maulana et al., 2023; Chaminuka et al., 2021). In densely populated and land-constrained coastal cities, urban farming offers strategic value by shortening supply chains and strengthening local resource loops (Azunre et al., 2019; Nasruddin et al., 2022). Yet despite its demonstrated benefits, urban farming is frequently marginalized in formal policy and planning frameworks. It is often grouped within broader agricultural sectors, rendering its specific economic contributions and environmental benefits invisible in official statistics and performance assessments (Zezza & Tasciotti, 2010; Abdullah et al., 2017). This under-recognition parallels broader weaknesses in urban environmental accounting, particularly in contexts where land use and land cover (Teoh et al., 2024) changes increase flood risks and reduce ecological resilience, as seen in Skikda, Algeria (Leulmi et al., 2023).

From a theoretical standpoint, urban farming aligns with contemporary paradigms such as urban metabolism, the circular economy, and green city development—models that prioritize closed-loop systems, resource efficiency, and integrated planning (Carolan, 2020; Mabon et al., 2023). At the household and community level, it represents an entry point for building livelihood resilience, defined as the ability to maintain well-being in the face of climate shocks, economic uncertainty, and disruptions in the food system (Gunapala et al., 2025). However, the success of such strategies often hinges on public awareness, behavioral adaptation, and local engagement. For instance, research in Northeastern Algeria shows

that farmers' awareness of climate variability significantly shapes their adaptive responses and long-term capacity (Nasri et al., 2024).

Several Asian cities offer illustrative examples of how institutional and grassroots support can enable urban farming to drive economic and environmental gains. In Seoul, South Korea, the Seoul Urban Agriculture Plan has facilitated improved food access, civic participation, and the revitalization of underused green areas (Feng et al., 2022). In Bangkok, Thailand, rooftop gardens managed by local communities have contributed to food security and microclimate regulation while fostering environmental education (Thomaier et al., 2015). Shanghai, China, demonstrates how urban agriculture—supported by technologies like vertical farming—can create jobs and sustain local food systems in dense metropolitan areas (Orsini et al., 2013). These cases collectively illustrate the transformative potential of urban farming when integrated into city-wide development and environmental accounting frameworks.

Despite these precedents, empirical research on the economic and environmental impacts of urban farming remains limited, particularly in small- and medium-sized coastal cities in the Global South. Much of the literature emphasizes its social and nutritional dimensions, while rigorous evaluations of its quantifiable economic contributions and environmental performance indicators (e.g., energy use, emissions, air quality) are scarce (McClintock et al., 2018; AGCI, 2011). This evidentiary gap restricts the formulation of evidence-based policies and obstructs the incorporation of urban farming into mainstream development accounting systems.

Kendari City, a fast-growing coastal city in Eastern Indonesia, exemplifies this gap. The city's economy grew from 3% in 2018 to 4% in 2023 (Central Statistics Agency Kendari City, 2023), yet urban farming activities remain largely informal and fragmented. Government interventions have primarily focused on input distribution such as composters and seedlings without meaningful integration into broader spatial or development plans (Amir & Saidin, 2020). Nonetheless, recent studies underscore the sector's value in improving food availability and supporting vulnerable livelihoods (Bindarto et al., 2024; Alwi et al., 2024).

Despite its growing relevance, no study to date has comprehensively assessed urban farming's dual role in both economic development and environmental sustainability using integrated and measurable indicators. This study addresses that gap through an empirical case study of Kendari City. Specifically, it evaluates (1) the economic contribution of urban farming within the agriculture, forestry, and fisheries segment of the Gross Domestic Regional Product (GDRP), and (2) Kendari's environmental performance through the Asian Green City Index (AGCI), focusing on metrics such as energy use, CO_2 emissions, and air quality. These indicators are analyzed to frame urban farming within an economic and environmental accounting perspective, enabling a holistic assessment of its role in building resilient, low-carbon coastal cities.

In doing so, this research offers timely insights into how urban farming when systematically integrated and institutionally supported can contribute to livelihood resilience, environmental performance, and SDG-aligned development in coastal urban areas. By positioning urban farming at the intersection of urban planning, economic accounting, and ecological transition, the study strengthens the empirical foundation for advancing sustainable urbanization across the Global South.

Materials and methods

This study was conducted in Kendari City, a coastal urban area located along Kendari Bay in Southeast Sulawesi, Indonesia (Figure 1). Kendari was purposively selected as the research site due to its rapid urban development, demographic expansion, and growing environmental pressures conditions that make it an ideal context for exploring urban sustainability through the lens of urban farming. As of 2023, Kendari's population had grown to approximately 404,232, rising from 392,830 in 2019 (Central Statistics Agency Kendari City, 2023), reinforcing its status as a medium-sized coastal city experiencing urban agglomeration.

Fig. 1. Location of Kendari City, Southeast Sulawesi Province, Indonesia

Urban farming activities in Kendari currently utilize an estimated 6,820.85 hectares, equivalent to 25% of the city's total area of 27,176 hectares. This makes urban agriculture not only spatially significant but also relevant for examining how localized food production contributes to economic output and environmental resilience in a coastal urban setting.

The research employed a descriptive quantitative approach to investigate three main aspects: the economic contribution of urban farming, its spatial extent, and its relationship with urban environmental performance. The analysis was structured around a multi-dimensional

framework informed by the Asian Green City Index (AGCI) (AGCI, 2011; Pace et al. 2016), focusing on the interaction between economic sectors and sustainability indicators.

The economic analysis centered on the Gross Domestic Regional Product (GDRP), particularly the agriculture sector, which includes forestry and fisheries. The study assessed the extent to which urban farming contributes to this sector in terms of economic value (in Indonesian Rupiah) and percentage share. Spatial analysis focused on the area of land under active cultivation within urban boundaries, measured in hectares.

Environmental sustainability was evaluated through two dimensions. The first dimension, energy and emissions, included per capita electricity consumption (kWh/person) and total city-level CO_2 emissions (in tons). These were complemented by qualitative assessments of energy and climate policies, such as the adoption of clean energy initiatives, the existence of climate mitigation strategies, and the implementation of renewable energy programs. The second dimension, air quality, involved measuring concentrations of three pollutants nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM_{10}) on a daily average basis (μg/Nm³/day), and reviewing relevant clean air management policies.

Secondary data for economic performance and environmental indicators were obtained from official sources, including the Central Statistics Agency (BPS) of Kendari, the Kendari Environmental Agency, and the Southeast Sulawesi Provincial Environmental Office. Environmental quality data particularly related to air quality—were retrieved from the Air Quality Monitoring System (AQMS), which provides real-time, location-specific data collected by authorized monitoring stations. To supplement these data, primary field observations were conducted to document on-site urban farming activities, assess community practices, and identify gaps in policy implementation related to climate mitigation and sustainable energy use.

Environmental indicators were further analyzed using a weighted scoring system derived from the AGCI. The observed values for energy consumption, CO_2 emissions, and air quality were compared against AGCI benchmarks, and each component was assigned a proportional weight. The quantitative formula applied was:

$$\text{Weight (\%)} = \left(1 - \frac{\text{Obtained Value}}{\text{Environmental quality standar value}}\right) xWeight(25\%) \quad (1)$$

For quantitative evaluation of the sustainability of a city based on energy use, CO_2 emissions, and air quality, the calculation is as follows (Boni et al., 2023):

$$\text{Value Weight (\%)} = \left(\frac{\text{Total score}}{\text{Highest Score}}\right) xWeight(\%) \quad (2)$$

Subsequently, the total sustainability score for Kendari was calculated by aggregating individual component scores and comparing the result to AGCI classification thresholds. Cities were then categorized into five levels of sustainability performance: well above average (81–100%), above average (61–80%), average (41–60%), below average (21–40%), and well below average (0–20%) (Boni et al., 2023; Rostin et al., 2023). Through this integrated approach, the study provides a comprehensive analysis of how urban farming contributes not only to economic productivity, but also to the broader agenda of environmental sustainability in coastal city contexts.

Results

Economic Dynamics and the Embedded Role of Urban Farming in Kendari's Regional Economy

Kendari City, as the provincial capital of Southeast Sulawesi, exhibits a dynamic yet fluctuating pattern of economic growth over the 2018–2022 period. Based on data from the Central Statistics Agency of Kendari City (2023), the city's GDRP experienced a significant contraction in 2020, recording a negative growth rate of –3.04%, as a direct consequence of the COVID-19 pandemic and its broader economic repercussions. This downturn was followed by a strong rebound in 2021 with 8.57% growth—the highest during the observed period. In 2022, growth slowed to 3.03%, reflecting a post-recovery stabilization. These trends (see Figure 2) reveal that Kendari's economy is moderately resilient but remains highly susceptible to exogenous shocks, underscoring the need for a more diversified and resilient urban economic structure.

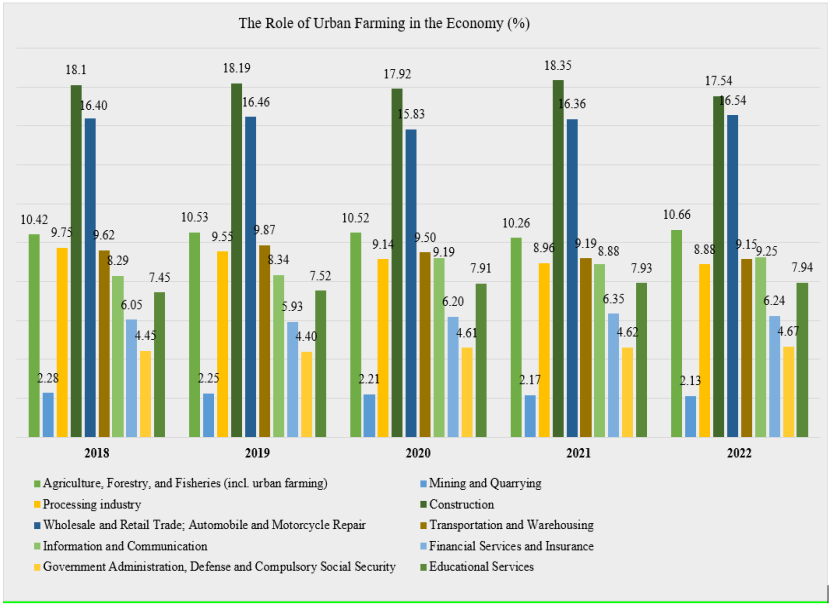

Fig. 2. Urban farming's role in Kendari City's economy 2018-2022. Source: Author's Analysis Results processed from the Kendari City Central Statistics Agency, (2023)

As of 2022, Kendari's total GDRP at constant prices stood at approximately IDR 18.01 trillion, distributed across 17 main economic sectors. The construction sector emerged as the largest contributor (17.54%), followed by wholesale and retail trade (16.54%). Notably, the agriculture, forestry, and fisheries (AFF) sector—which includes urban farming—ranked third, generating IDR 1.92 trillion or 10.66% of the city's total output. Although urban farming is not disaggregated as a separate sub-sector in GDRP classification, its contribution is embedded within the AFF sector, highlighting its significance in land-based production and urban food systems.

From an economic accounting perspective, the inability to isolate the financial value of urban farming reflects a critical gap in sectoral financial reporting and local government budgeting systems. This absence of disaggregated data renders urban farming effectively unrecorded in terms of its specific contribution—limiting its visibility in both fiscal planning and

sustainable development financing. This reflects a broader issue in urban economic accounting, wherein informal or hybrid practices are undervalued despite their growing impact on food security and employment (Zezza & Tasciotti, 2010; Abdullah et al., 2017).

The inclusion of urban farming within the AFF sector also implies that its contribution is structurally underrepresented in current development metrics, even though it plays a growing role in localizing food systems and supporting low-emission livelihoods. In Kendari, urban agriculture encompasses food crops, horticulture, smallholder livestock, aquaponics, and peri-urban fisheries, which collectively contribute to the city's output but are not individually tracked. As such, the lack of a specific budget line or accounting framework for urban agriculture hampers the formulation of supportive urban policies and the mobilization of climate-aligned investments (Bindarto et al., 2024; Alwi et al., 2024).

Over the observed period, the aggregate value of Kendari's GDRP displayed a gradual upward trend (see Figure 2), though not always accompanied by consistent growth rates. This decoupling between output volume and sectoral expansion suggests the presence of economic saturation, post-pandemic volatility, or shifting public investment priorities, as previously discussed by Balaka et al. (2023) and Saputra et al. (2024).

Throughout 2018–2022, the AFF sector—urban farming included—retained its position as the third-largest contributor to Kendari's regional economy. In contrast, sectors such as electricity and gas, water management, and waste services remained marginal (<1% of GDRP). Sectoral trend analysis shows that of the 17 sectors, one remained constant (electricity and gas), six increased in contribution, five declined, and five showed high fluctuation. The AFF sector fell into the fluctuating category, partly influenced by environmental shocks and inconsistent policy support.

Focusing more narrowly on urban farming, data indicate that its share within the AFF sector increased by 0.24% during the period, although its sectoral growth rate declined by 0.13% between 2018 and 2022. The weakest performance occurred between 2019 and 2021, coinciding with reduced mobility, delayed supply chains, and the absence of stimulus policies targeting informal producers during the pandemic (Amir & Saidin, 2020). Despite these setbacks, urban farming regained momentum in 2022, with a total cultivated area of 6,820.85 hectares, covering approximately 25% of Kendari's urban land area. Spatially, this is significant; however, its economic valuation remains obscured, as official reports aggregate its output with broader AFF data, making its specific economic impact unrecorded and undervalued.

From a public sector accounting and green budgeting standpoint, this underscores the urgent need for disaggregation mechanisms, improved data granularity, and urban-farm-specific indicators to strengthen fiscal visibility and policy relevance. The development of localized environmental-economic accounting frameworks (e.g., satellite accounts for urban agriculture) would allow Kendari to more accurately reflect urban farming's contribution in regional development planning and sustainability tracking systems (Carolan, 2020; Mabon et al., 2023).

Ultimately, recognizing and accounting for urban farming's economic footprint is not only a technical matter of classification—it is a strategic imperative for unlocking green growth potential, advancing livelihood resilience, and aligning urban policy with Sustainable Development Goals (SDGs) and climate action frameworks at the local level.

Energy and CO_2 in Kendari City: An Environmental Accounting Perspective

In 2020, the State Electricity Company (PLN) of Southeast Sulawesi reported that Kendari City's electricity production reached 596,708,128 kWh, primarily supplied by the Wua-Wua and Benu-Benua power plants. These two facilities accounted for more than 99% of total production, with Wua-Wua contributing 69.51% and Benu-Benua 30.49%. However, the volume of electricity distributed to end-users was lower, totalling 440,278,279 kWh. With Kendari's population reaching 392,830 during the same year, this translates into an average per capita electricity consumption of 1,121 kWhm a figure well above the 900 kWh/person benchmark established by the Asian Green City Index (AGCI) for green urban areas.

From an environmental accounting perspective, such elevated energy use directly correlates with a high emissions load, presenting a measurable and auditable environmental cost. Based on standard emissions factors commonly used in environmental impact reporting (AGCI, 2011), Kendari's total electricity-based CO_2 emissions were estimated at 316,560.08 tons. This quantitative assessment provides a clear basis for environmental performance valuation in line with green accounting frameworks, such as the UN's System of Environmental-Economic Accounting (SEEA) and The Organization for Economic Co-operation and Development (OECD) Green Growth Indicators (United Nations, 2014; OECD, 2017).

When weighted against the AGCI's composite index criteria, Kendari's performance in energy use and emissions management yielded a negative score of –13.39%, placing the city in the "well below average" category for sustainable energy systems. Such classification suggests that the city is not yet on track to decouple economic activities (including urban agriculture and construction) from carbon-intensive energy use, a key principle in both sustainability accounting and low-carbon development planning (Mabon et al., 2023; Carolan, 2020).

In addition to the quantitative findings, qualitative assessments of Kendari's energy governance revealed partial progress in clean energy adoption. Positive efforts were noted in the form of public awareness campaigns, installation of solar-powered street lighting, and the promotion of smart electricity usage among urban residents. Nonetheless, the overall qualitative score for energy and CO_2 management stood at only 41.66%, categorized as "meeting the average" under AGCI standards. This implies that while individual programs exist, they lack the institutional integration and financial accountability needed for transformative impact.

When combining both the quantitative (–13.39%) and qualitative (41.66%) scores, the city's overall performance in energy and CO_2 management was rated at 28.27%, still below AGCI's expected threshold. From an environmental accounting standpoint, this reveals a gap in both reporting mechanisms and strategic investment alignment, where environmental externalities remain partially internalized within development policy, and emission data is not yet systematically linked to sectoral planning (Hariyati & Tarjo, 2020).

Importantly, these challenges hold direct implications for the sustainability of urban farming in Kendari. As the city attempts to mainstream urban agriculture within its land use and economic development strategies, ensuring energy efficiency and carbon reduction becomes essential. In environmental accounting terms, this underscores the urgency of adopting life-cycle accounting, energy audits, and carbon budgeting tools to capture the full environmental footprint of both food production and energy systems (Schaltegger & Burritt, 2010).

In sum, Kendari's current energy and emissions profile highlights a misalignment between environmental targets and accounting practices. Without a robust environmental accounting system that integrates urban farming, energy consumption, and emissions data, the city risks undermining its own resilience objectives. Moving forward, embedding environmental indicators within the city's performance-based budgeting, and promoting sectoral carbon audits for high-impact activities—including urban agriculture—would be critical steps toward aligning with SDG 13 (Climate Action) and SDG 11 (Sustainable Cities and Communities).

Air Quality in Kendari City: Toward Integrated Environmental and Livelihood Accounting

Air quality is a fundamental component of environmental sustainability and urban health, particularly in rapidly developing coastal cities. In Kendari, the assessment of air quality was conducted using both quantitative and qualitative methods. Quantitatively, the focus was on daily concentrations of nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM_{10}). Qualitatively, policy effectiveness was evaluated in relation to existing air management initiatives.

The quantitative results demonstrate that Kendari's ambient air quality remains within acceptable thresholds, as defined by the Asian Green City Index (AGCI). For the monitoring months of September to November, recorded levels of NO_2 ranged from 3–4 $\mu g/m^3$, SO_2 from 4–7 $\mu g/m^3$, and PM_{10} from 4–6 $\mu g/m^3$. These values consistently fall below AGCI's danger levels, indicating a relatively low level of industrial air pollution and mobile emissions. When benchmarked using AGCI's scoring standards, Kendari's total weighted performance score for air quality reached 69.73%, classifying the city as having a "very good" performance in air pollution control and ecological health.

From an environmental accounting perspective, these figures reflect positively on Kendari's ecological asset management, particularly in urban sectors that support green infrastructure and low-carbon practices. Good air quality represents a public environmental good whose value can be incorporated into broader urban natural capital accounting frameworks, especially under the System of Environmental-Economic Accounting (SEEA) endorsed by the United Nations (United Nations, 2014). In cities where urban farming is being scaled, clean air directly contributes to the biophysical productivity of crops and the economic viability of urban agriculture (Orsini et al., 2013).

However, the qualitative evaluation tells a more nuanced story. Despite successful programs such as tree planting, car-free days, emission inspections, and the installation of air quality monitoring stations, the city's qualitative policy score remains at only 17.19%, slightly below AGCI's benchmark for effective governance in air quality control. This indicates that while air quality outcomes are strong, the policy architecture behind them lacks institutional robustness, potentially undermining future sustainability if economic pressures increase.

The composite score, combining quantitative and qualitative metrics, stands at 43.46%, positioning Kendari at an "average" level of performance relative to AGCI standards. In the context of environmental and livelihood accounting, this dual-score approach provides a balanced performance ledger, revealing that environmental outcomes can be decoupled from weak policy frameworks, but such decoupling may not be sustainable in the long term without structural policy investments.

For urban farming systems, maintaining air quality is not merely an ecological concern—it is a critical production factor. Studies have shown that high concentrations of NO_2 and SO_2 can reduce photosynthetic efficiency and impair crop yields, while PM_{10} deposits may degrade soil quality (Thomaier et al., 2015; McClintock et al., 2018). Hence, ensuring high ambient air quality contributes both to ecosystem services and to the economic sustainability of urban farming enterprises. In accounting terms, this forms part of a "livelihood-environment nexus", where air quality is treated as both an environmental asset and an input to income-generating activities (Schaltegger & Burritt, 2010).

Integrating air quality data into the city's urban planning and financial accounting—particularly through air pollution externality valuation, ecosystem service mapping, and green budgeting tools—would allow Kendari to enhance its environmental decision-making capacity while reinforcing its urban farming agenda. This also aligns with SDG 11 (Sustainable Cities and Communities) and SDG 2 (Zero Hunger), emphasizing the role of environmental quality in sustaining urban food systems and livelihood resilience.

Discussion

The case of Kendari, a coastal urban center in Southeast Sulawesi, Indonesia, provides a valuable perspective for understanding the intertwined economic and environmental roles of urban farming in a developing urban context. Empirical findings from 2018 to 2022 reveal that urban farming, although statistically unrecorded as a distinct sub-sector, is functionally embedded within the broader agriculture, forestry, and fisheries (AFF) sector, contributing to both household livelihood strategies and sustainable urban development pathways.

The AFF sector was the third-largest contributor to Kendari's Gross Domestic Regional Product (GDRP) in 2022, accounting for 10.66% of total output. Within this aggregate, urban farming including horticulture, food crops, livestock, and fisheries constitutes a critical though informally organized set of activities. Despite this relevance, the specific economic contribution of urban farming remains unrecorded in formal sectoral financial reporting, a situation that reflects what environmental accountants refer to as "hidden flows" economic and ecological values that are significant in function but excluded from official accounting frameworks (Maulana et al., 2023; Poulsen et al., 2017; Schaltegger & Burritt, 2010). This invisibility limits the capacity of local governments to leverage urban farming as a policy instrument for resilience and economic diversification.

Urban farming in Kendari largely operates on a necessity-driven basis. As in other coastal cities such as Accra and Manila, it serves to enhance food security and supplement income among urban households with limited access to formal employment (Berdegué et al., 2014; Zezza & Tasciotti, 2010). Between 2018 and 2022, the share of urban farming within the AFF sector rose slightly by 0.24%, though its sectoral growth rate declined by 0.13%, suggesting that structural constraints such as limited land access, inadequate infrastructure, and underinvestment have dampened its development potential (Amir & Saidin, 2020; Acquah et al., 2020). These findings underline the urgent need for disaggregated data and policy tools that formally recognize the economic value of urban agriculture. Tools like the System of Environmental-Economic Accounting (SEEA) are increasingly advocated for to address this gap by integrating ecological functions and ecosystem services into national and regional accounts (Paudel & States, 2023).

Beyond its economic implications, urban farming holds potential as a mitigation strategy within Kendari's broader environmental context, particularly in relation to energy use and carbon emissions. In 2020, the city's per capita electricity consumption reached 1,121 kWh, surpassing the green city threshold of 900 kWh/person recommended by the Asian Green City Index (AGCI). Concurrently, CO_2 emissions from electricity use were estimated at over 316,000 tons, contributing to Kendari's poor environmental score of 28.27% in energy and emissions management. From an environmental accounting perspective, these figures signal high externalities from fossil-fuel-based energy systems costs that are not reflected in traditional economic metrics but have real implications for environmental degradation and climate vulnerability. If appropriately supported, urban farming could serve as a low-carbon strategy by reducing food transportation distances, recycling organic waste through composting, and expanding green cover within the urban fabric (Orsini et al., 2013; Mabon et al., 2023).

The concept of shadow pricing assigning economic value to environmental harms such as CO_2 emissions can help make the case for green infrastructure investment and low-emission urban agriculture. As demonstrated in cities like Medellín and Kampala, the alignment of urban farming initiatives with renewable energy transitions has proven effective in advancing both environmental and economic goals (Montoya, 2024; GIZ, 2022). For Kendari, integrating such principles into its development planning would enhance accountability and help realign the city's growth model with its sustainability ambitions.

In addition to energy-related concerns, air quality in Kendari presents a relatively optimistic outlook. Quantitative data showed that the concentrations of NO_2, SO_2, and PM_{10} remain within safe thresholds, with an AGCI-based score of 69.73% well above the regional average. However, the qualitative dimension of policy and institutional capacity received a much lower score of 17.19%, pointing to weaknesses in regulatory enforcement and public engagement. This discrepancy indicates that while the current air quality is acceptable, the city lacks robust mechanisms to ensure long-term improvement or resilience against future degradation.

The implications for urban farming are direct: clean air enhances the health of both crops and farmers, while the vegetation cultivated through urban agriculture can in turn improve local air quality by filtering pollutants and enhancing microclimates (McClintock et al., 2018). These ecosystem services, though often unpriced, represent a form of natural capital that deserves inclusion in environmental and urban accounting frameworks. In this way, urban farming not only contributes to food security and livelihoods but also performs essential ecological functions, reinforcing the argument for its formal integration into urban development strategies.

Ultimately, the Kendari case reveals the need for a governance approach that integrates economic growth and environmental sustainability as mutually reinforcing goals. While urban farming remains underrecognized in policy and accounting systems, its multifunctional role in food systems, climate resilience, and ecological services underscores its strategic potential. The transition from informal practice to institutionalized urban strategy requires not only conceptual recognition but also technical adaptation of budgeting, land-use planning, and intersectoral coordination. This foundation is essential for transforming urban farming from a subsistence measure into a formal pillar of sustainable city-building in the Global South.

Implications for Policy and Urban Governance

The findings of this study underscore the urgent need for a multidimensional governance approach that positions urban farming as a strategic instrument within urban accounting, environmental stewardship, and sustainable development frameworks. In Kendari an urbanizing coastal city facing demographic pressures, ecological vulnerability, and economic disparity urban farming holds potential to support SDG 2 (Zero Hunger), SDG 11 (Sustainable Cities), and SDG 13 (Climate Action).

Realizing this potential requires several key shifts. First, urban farming must gain institutional recognition in planning and budgeting processes to ensure land access, investment, and programmatic support. Second, disaggregated economic data are essential to capture its contributions within the AFF sector, making its value visible in financial reporting. Third, the application of environmental-economic accounting tools (e.g., SEEA) would allow policymakers to value urban farming's ecological services such as carbon sequestration and waste reduction, and to internalize environmental externalities. Fourth, capacity building for both farmers and institutions is vital to promote sustainable, climate-resilient agricultural practices. Lastly, policy coherence across food, energy, and environmental domains is necessary to ensure integration within broader urban systems.

Kendari's case provides a relevant example for other medium-sized coastal cities in the Global South. Embedding urban farming into city governance systems—supported by robust data, financing, and coordination—can strengthen resilience and promote inclusive, low-carbon urban development.

Conclusion

This study has demonstrated the dual role of urban farming in advancing economic development and environmental sustainability within the context of a rapidly urbanizing coastal city Kendari, Indonesia. By analyzing urban farming's contribution to the agriculture, forestry, and fisheries (AFF) sector in the city's Gross Domestic Regional Product (GDRP), the findings reveal a significant yet unrecorded component of the regional economy. Although urban farming activities are currently subsumed within broader AFF classifications, their embedded value underscores the need for disaggregated accounting frameworks to improve visibility and inform targeted investment.

From an environmental accounting perspective, the study applied the Asian Green City Index (AGCI) to assess Kendari's performance on energy use, CO_2 emissions, and air quality. Results indicate that while energy intensity and emissions remain above green city thresholds, air quality remains relatively strong. Urban farming is shown to offer multifunctional environmental benefits reducing emissions, enhancing green cover, and improving microclimates which warrant formal recognition within ecological accounting and urban sustainability metrics.

The integration of urban farming into economic and environmental accounting systems such as the System of Environmental-Economic Accounting (SEEA) can serve as a strategic foundation for cities aiming to promote low-carbon development, enhance food system resilience, and localize Sustainable Development Goals (SDGs). In this way, urban farming not only addresses immediate livelihood concerns but also contributes measurable value to long-term urban resilience.

Ultimately, this research contributes to the growing discourse on sustainable urbanization in the Global South by offering an accounting-based empirical assessment of urban farming's value. It argues for the institutionalization of urban agriculture as a cross-sectoral planning instrument, bridging the domains of urban governance, green economy, and ecological infrastructure thereby enabling more equitable and sustainable urban futures.

Limitations and Recommendations for Future Research

This study has several limitations. First, the economic role of urban farming could not be isolated in official GDRP data, as it remains embedded within the broader agriculture, forestry, and fisheries (AFF) sector. This limits precise accounting of its financial contribution. Future research should employ disaggregated data and field-level surveys to capture its specific economic impact.

Second, the environmental analysis focused primarily on energy use, CO_2 emissions, and air quality based on AGCI indicators. Broader ecological dimensions such as water use, soil health, and biodiversity were not fully examined. Integrating tools like the System of Environmental-Economic Accounting (SEEA) could enable more comprehensive assessments.

Third, as a single-case study of Kendari, the findings may not be fully generalizable. Comparative research across coastal cities in the Global South would enhance contextual understanding and policy relevance.

Despite these limitations, this study offers evidence that urban farming can be a viable strategy for enhancing economic and environmental resilience in coastal cities. Future studies should focus on better data systems, intersectoral policy integration, and quantifiable metrics to support its institutionalization within sustainable urban development agendas.

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