

URBAN AGRICULTURE AS ADAPTIVE URBANISM: TOWARD RESILIENT AND LIVABLE CITIES

Jurnal Pengembangan Kota (2026)

Volume 14 No.1 (19–31)

Tersedia online di:

<http://ejournal2.undip.ac.id/index.php/jpk>

DOI: 10.14710/jpk.14.1.19-31

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Abstract. Urban agriculture (UA) is increasingly recognized for its food, ecological, and social contributions. Yet, these benefits do not automatically translate into enduring urban planning capacities. This conceptual paper asks how UA can operate as adaptive productive green infrastructure and which spatial and governance conditions enable or constrain that transition. Using a narrative and interpretative synthesis organized around six interrelated themes, the paper develops a conditional transformation framework and illustrates its planning implications through purposively selected literature-based examples from Singapore, Bangkok and Rotterdam. The synthesis identifies a pathway connecting spatial recognition, negotiated and secure access, enabling governance, adaptive cultivation practices, and context-dependent resilience and livability outcomes, with monitoring and feedback linking these stages. The cases illuminate contrasting planning and institutional arrangements rather than establish causal policy effects. The paper contributes a framework for interpreting UA as a place-based expression of adaptive urbanism and proposes planning instruments concerning land-use recognition, access agreements, co-management, technical support, and evaluation. These propositions require testing across different urban contexts.

Key Words: *Urban Agriculture; Adaptive Urbanism; Urban Resilience; Urban Livability; Community-Based Adaptation; Productive Green Infrastructure.*

[Judul: PERTANIAN PERKOTAAN SEBAGAI URBANISME ADAPTIF: MENUJU KOTA TANGGUH DAN LAYAK HUNI]. Pertanian perkotaan memiliki potensi manfaat pangan, ekologis, dan sosial, tetapi manfaat tersebut tidak serta-merta berkembang menjadi kapasitas perencanaan kota yang berkelanjutan. Artikel konseptual ini mengkaji bagaimana pertanian perkotaan dapat berfungsi sebagai infrastruktur hijau produktif yang adaptif serta kondisi spasial dan tata kelola yang memungkinkan atau membatasi transformasi tersebut. Melalui sintesis literatur naratif dan interpretatif yang disusun dalam enam tema, artikel ini mengembangkan kerangka transformasi bersyarat dan mengilustrasikan implikasinya melalui contoh berbasis literatur dari Singapura, Bangkok, dan Rotterdam. Kerangka tersebut menghubungkan pengakuan spasial, kepastian dan negosiasi akses, tata kelola pendukung, praktik adaptif, serta potensi hasil bagi ketangguhan dan kelayakhunian kota, disertai pemantauan dan umpan balik. Perbandingan kota menunjukkan variasi pengaturan kelembagaan, bukan bukti hubungan kausal kebijakan. Kontribusi artikel berupa kerangka interpretatif dan usulan instrumen perencanaan yang perlu diuji lebih lanjut dalam beragam konteks perkotaan.

Kata Kunci: *Pertanian Perkotaan; Urbanisme adaptif; Resiliensi perkotaan; Kelayakhunian perkotaan; Adaptasi berbasis komunitas; Infrastruktur hijau produktif*

Citation: Wardhani, Dhiyan Krishna., Wastunimpuna, Benediktus Yosef Arya., Ismail, Amrizarois., & Abramesti Mikhael. (2026). URBAN AGRICULTURE AS ADAPTIVE URBANISM: TOWARD RESILIENT AND LIVABLE CITIES. *Jurnal Pengembangan Kota*. Vol 14 (1): 19-31. DOI: 10.14710/jpk.14.1.19-31

1. INTRODUCTION

Cities worldwide are progressively dealing with a host of intricate and interconnected challenges,

which include climate change, food insecurity, environmental harm, biodiversity decline, and social and spatial inequalities (García-Sempere et al., 2018). Rapid urbanization has intensified

pressure on urban ecosystems, often resulting in reduced green space, fragmented ecological networks, and growing vulnerability to environmental and economic shocks (McPhearson et al., 2015). At the same time, urban residents face increasing uncertainty regarding access to food, healthy living environments, and social well-being (Seto & Ramankutty, 2016).

These circumstances have incited an increasing scholarly interest in adaptive methodologies pertaining to urban development, which can bolster the ability of urban environments to effectively respond to transformations, all the while preserving vital social, ecological, and economic functionalities (Quigley et al., 2018). In this context, adaptive urbanism has surfaced as a conceptual framework that underscores the importance of flexibility, resilience, and the capacity of urban systems to adapt to changing conditions (Ribeiro & Pena Jardim Gonçalves, 2019). Rather than relying solely on large-scale infrastructural interventions, adaptive urbanism recognizes the importance of incremental, community-based, and place-specific practices that contribute to long-term urban sustainability (Egerer et al., 2021). This approach aligns with the principles of urban resilience, emphasizing the need for cities to maintain desired functions and adapt to disturbances while fostering community engagement and ecological integration (Cao, 2023). By integrating urban agriculture into adaptive urbanism, cities can enhance their resilience and ensure food security, while simultaneously promoting social cohesion and environmental sustainability (Zeeuw et al., 2011). This integration highlights the potential of urban agriculture to serve as a multifunctional tool, addressing food security and fostering community ties while contributing to the overall resilience of urban systems (Orsini et al., 2020). Integrating urban agriculture into adaptive urbanism not only enhances food security but also strengthens social networks, thereby contributing to the overall resilience of urban environments (McClymont et al., 2020) and promoting a more sustainable urban future. Emphasizing local food production can also mitigate the impacts of climate change and urbanization, ultimately fostering healthier, more equitable communities (Feenstra, 1997). This multifaceted approach positions urban agriculture as a vital strategy for cities to navigate the

complexities of contemporary challenges and enhance their adaptive capacity.

One practice that has gained increasing attention in recent years is urban agriculture. Traditionally understood as the cultivation, processing, and distribution of food within urban and peri-urban areas, urban agriculture has evolved beyond its food production function (Krishnan et al., 2016). Emerging evidence suggests that urban agriculture contributes to environmental management, social cohesion, public health, local economic development, and climate adaptation (Zeeuw et al., 2011). Urban farms, community gardens, rooftop agriculture, and productive landscapes increasingly serve as multifunctional urban spaces that provide both ecological and social benefits (Szumigala & Szumigala, 2018) and can play a crucial role in enhancing urban resilience. By fostering community engagement and providing green spaces, urban agriculture not only addresses food insecurity but also contributes to the overall sustainability and adaptability of urban systems (Gulyas & Edmondson, 2021). Moreover, urban agriculture's role in enhancing urban resilience is further underscored by its ability to promote circular economies and improve public health outcomes, thereby addressing multiple urban challenges simultaneously (Gulyas & Edmondson, 2021). This multidimensional approach positions urban agriculture as a cornerstone in the development of resilient cities, capable of addressing pressing socio-ecological challenges while fostering sustainable urban environments.

Despite these recognized contributions, urban agriculture remains marginal within many urban planning frameworks (Neilson & Rickards, 2017). In many cities, it is often regarded as a temporary land use, informal activity, or community initiative rather than a strategic component of urban development (Rafieian & Kianfar, 2023).

ISSN 2337-7062 © 2026 by Authors,

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Submitted 20 May 2026, accepted 6 July 2026

Consequently, its potential role in enhancing urban resilience and livability remains underexplored.

This paper argues that urban agriculture should be understood as a form of adaptive urbanism that enables cities to respond to contemporary urban challenges while simultaneously improving urban livability. Through a conceptual synthesis of literature on urban resilience, urban livability, adaptive urbanism, and urban agriculture, the paper explores how productive green spaces can function as adaptive infrastructures that strengthen both ecological and social capacities within cities.

The conceptual gap addressed here is not whether UA offers multiple benefits, but how those benefits become durable planning capacities under different land-use and governance arrangements. Existing reviews document of UA's multifunctionality and persistent regulatory barriers, yet rarely articulate a common sequence linking spatial recognition, secure access, community stewardship, and adaptive outcomes within a single planning-oriented explanation. Accordingly, this paper ask through which mechanism can urban agriculture operates as adaptive productive green infrastructure, and what planning conditions enable or constrain that transition. Its contribution is an interpretative transformation framework and a set of conditional planning proposition, rather than a causal estimate of policy effectiveness.

2. METHOD

This paper adopts a conceptual, exploratory design based on narrative and interpretative literature synthesis. The literature discussed in the manuscript was organized into six interconnected analytical themes, namely multifunctionality, green infrastructure integration, climate adaptation and resilience, livability, circular resource flows, and planning and governance. The synthesis compares convergent and divergent findings, identifies recurring institutional constraints, and interprets the relationships between benefits and the conditions under which they may persist. Three literature-based city illustrations were purposively selected for their contrasting planning and governance configurations: Singapore for formal land-use recognition and interagency coordination;

Bangkok for legal and land-access constraints; and Rotterdam for experimentation and institutional alignment. The cases are used as analytical illustrations, not as a representative sample or controlled comparison. On this basis, the paper proposes a conditional transformation pathway and planning propositions for future empirical testing. No primary field data were collected and no systematic search or causal evaluation is claimed.

The analytical sequence proceeds from identifying documented UA functions, through interpreting their spatial and institutional enabling conditions, to formulating potential resilience and livability outcomes. The framework therefore distinguishes observed or reported benefits in the reviewed literature from the paper's own conceptual propositions. Because the synthesis is selective and interpretative, it cannot establish the frequency of findings across the entire literature or verify policy effectiveness across cities

3. RESULTS & DISCUSSION

The conceptual synthesis of literature on urban resilience, urban livability, adaptive urbanism, and urban agriculture yielded six interrelated themes that together describe the conceptual territory of the paper. Each theme is presented below as it emerged from the synthesis, supported by the patterns, relationships, and convergences identified across the reviewed sources.

Theme 1: Urban Agriculture as a Multidimensional Practice Beyond Food Provision

The first and most consistently recurring theme in the literature is that urban agriculture has expanded conceptually and functionally beyond its traditional food-production role into a multidimensional practice spanning social, ecological, economic, and cultural domains. Pradhan and co-authors' machine-learning-assisted review of approximately 1,450 publications found that the urban agriculture literature covers 14 topics clustered into 11 themes, small-scale ground-based systems, building-integrated systems, urban livestock, food systems transformation, food supply and livelihoods, health and educational benefits, social space and urban development, green

infrastructure and urban planning, urban land cover and ecosystem services, water and agricultural inputs, and health risks (Pradhan et al., 2023). Their analysis explicitly concludes that "promoting urban agriculture requires accounting for its multifunctionalities, besides food provisioning" (Pradhan et al., 2023). Orsini and colleagues, mapping multifunctional urban agriculture in the Global North, similarly find that UA delivers a portfolio of benefits that operate simultaneously across scales (Orsini et al., 2020). This pattern is echoed in Artmann and Sartison's framework-based review, which connects UA to ten distinct societal challenges: climate change, food security, biodiversity and ecosystem services, agricultural intensification, resource efficiency, urban renewal, land management, public health, social cohesion, and economic growth (Artmann & Sartison, 2018). Across these reviews, UA emerges not as a singular-purpose land use but as a reconfigurable socio-ecological practice.

Theme 2: Integration into Urban Green Infrastructure as a Pathway to Multifunctionality

The second theme positions UA within the broader family of urban green infrastructure as a strategy for delivering ecosystem services in planned and connected networks. Jones et al.'s feature-based typology of urban GI, developed with experts in Paris, Aarhus, and Velika Gorica, organizes 47 sub-categories of green and blue features into nine main categories, including gardens, parks, allotment/other growing spaces, city farms, adopted public space, linear features/routes, constructed GI on infrastructure, hybrid GI for water, and blue spaces (Jones et al., 2022). Their multivariate analysis identifies "multifunctionality" as a primary axis along which GI features vary: more natural, tree-dominated and blue features deliver a broader, more multifunctional portfolio of regulating ecosystem services, whereas hybrid features designed primarily for water management tend to deliver fewer co-benefits (Jones et al., 2022). Evans and co-authors' systematic review of 157 peer-reviewed articles comparing UA and green infrastructure notes that while both deliver ecosystem services, certain services, local climate and air quality regulation, are more effectively delivered by green infrastructure alone, whereas

biological control and the maintenance of genetic diversity are best supplied when green infrastructure is combined with UA (Evans et al., 2022). Evans et al. (2022), further identify community gardens, allotments, parks, and green spaces as the settings in which service delivery has been most frequently documented (Evans et al., 2022). Korkou, Tarigan, and Hanslin's systematic review of the multifunctionality concept in UGI planning argues that multifunctionality is not an incidental property but a prerequisite for impactful UGI planning, requiring the integration of spatial distribution, network connectivity, accessibility, and public participation (Korkou et al., 2023). These findings converge on a clear pattern. The multifunctional value of UA is unlocked most effectively when UA is planned as an integrated component of an urban green infrastructure network rather than treated as an isolated amenity.

Theme 3: Climate Adaptation and Resilience Capacities

The third theme concerns UA's contributions to climate adaptation, hazard mitigation, and the resilience capacities of urban systems. The IPCC's Climate Change and Land assessment attributes medium confidence to UA's role in climate mitigation and high confidence to its role in climate adaptation, with co-benefits for food security and reduced pollution (Intergovernmental Panel on Climate, 2022). The companion Climate Resilient Development Pathways assessment reinforces this, noting that urban agroecosystems increase resilience to supply shocks while contributing to community cohesion (Intergovernmental Panel on Climate, 2023). Pandey and Ghosh (2023), show how productive landscape approaches, including rooftop gardens, edible green walls, peri-urban cultivation, and stream-bank food production, enable cities to preserve low-lying areas from construction, reduce flood risk, manage stormwater, and improve thermal comfort under climate stresses. Egerer et al. (2021), illustrate these dynamics empirically in the Global South, where UA in Quito, Durban, and Gorakhpur has supported household-level climate adaptation through crop diversification and climate-resilient farming strategies. The COVID-19 pandemic served as an additional stress test: Iida et al. (2023), find that UA

in walkable neighborhoods contributed to health, food system resilience, climate-risk mitigation, biodiversity conservation, and community well-being during lockdowns, and Pulighe and Lupia (2020) similarly argue that the pandemic "boosted" interest in UA as a buffer against the fragility of long food supply chains. Across these sources, UA appears not as a marginal adaptation tactic but as a recurring strategy in resilience-building across multiple climate and shock scenarios.

Theme 4: Social Cohesion, Health, and Contributions to Urban Livability

The fourth theme links UA to the multi-dimensional construct of urban livability, which encompasses safety, attractiveness, environmental sustainability, equitable access to services, and social cohesion (Higgs et al., 2019; Khorrami et al., 2021). Ilieva et al. (2022), review of 272 publications across 57 countries finds that the bulk of social-impact research measures effects on community cohesion and engagement, followed by increased fruit and vegetable consumption, reduced food insecurity, and improved health and well-being. Audate et al.'s scoping review of 101 articles reports quantitative evidence of positive UA impacts on food security, nutrition, physical and mental health, and social capital, while emphasizing the need for more rigorous methods and attention to soil contamination risks (Audate et al., 2019). Rodríguez et al.'s case study of Quito's AGRUPAR program demonstrates that agroecological UA can simultaneously promote social cohesion, healthy nutrition, and a social and solidarity economy, thereby reducing vulnerability at the neighborhood scale (Rodríguez et al., 2022). Parker and Simpson's review of public green infrastructure establishes a broader empirical link between quality green spaces and city livability, identifying psychological, physiological, and societal outcomes for urban dwellers (Parker & Simpson, 2018). The convergence across these sources indicates that the livability contributions of UA derive not from a single attribute but from the simultaneous production of social, health, environmental, and experiential benefits.

Theme 5: Circular Economy Linkages and Urban Metabolism

The fifth theme connects UA to urban circular-economy transitions and the closing of resource loops. Riaño-Herrera et al. (2023), identify synergies between UA and the circular economy through compost and recycled fertilizers, renewable energy, hydroponic and vertical production, and industrial symbiosis. Chhour and Carrasquillo (2025), elaborate this logic by analyzing how secondary resources—including food-waste compost, wastewater irrigation, and urine-derived fertilizer—shift urban metabolism from linear resource use toward circular flows particularly valuable in water-scarce regions. Mendoza et al. (2026), model the Metropolitan Area of Barcelona and estimate that compost application can reduce the carbon footprint of peri-urban agriculture by up to 85%. Skar et al. (2019), frame UA as a "keystone contribution" to sustainable and healthy urban development by linking food systems to the urban water–energy–food nexus and enabling closed-loop designs. Together, these studies position UA within the wider material and energetic metabolism of the city, opening a pathway through which UA can reduce emissions, recover nutrients, and reuse water while still performing its traditional productive functions.

Theme 6: Persistent Marginalization in Urban Planning and Governance

Figure 1 presents a conditional transformation for multifunctional benefits that depend on land-use recognition, access arrangements, community governance, and iterative support permit productive spaces to persist and adapt. Outcomes should be assessed through locally appropriate indicators rather than presumed from the presence of cultivation alone.

The sixth and final theme addresses a structural inconsistency. Despite the documented benefits, UA remains marginal within urban planning frameworks in many contexts. Alkhaja et al. (2025), review of 51 articles identifies recurring obstacles, discord between civil and municipal actors, contextual factors weakening supportive policies, urban densification encroaching on UA land, and

tenure insecurity, and recommends flexible land-use and zoning ordinances, UA protection zones, and active civil-actor participation in planning. Onodugo et al. (2022), observe that in Nairobi, "urban agriculture is not an accepted urban land use and it is not classified in land use zoning". Issifu et al. (2025), studying Greater Kumasi, identify a "significant legislative gap" in land-use planning that hinders the integration of urban and peri-urban agriculture, with land tenure systems, infrastructure deficits, and housing design constraints further compounding the issue. Namalwa et al. (2026), a systematic review of 104 studies on informal-city settings finds that tenure insecurity, spatial constraints, and policy contradictions are particularly acute in slum contexts, where informal UA practices persist despite institutional marginalization. Wessels and Mgana (2024), research on Dar es Salaam similarly shows that UA is "merely tolerated in many African cities as long as it does not become a 'nuisance,'" with proposals favoring incremental tenure approaches and the recognition of informal actors. Merino et al. (2021), argue for trans-disciplinary, locally-led, planning-based, and multi-sectoral governance models that explicitly recognize the climate-adaptation, environmental, and food-security benefits of UA, particularly in Sub-Saharan Africa. The convergent pattern across these sources is unmistakable: in policy and planning terms, UA is more often tolerated than steered.

The synthesis of findings yielded by this review has implications for how scholars and practitioners conceptually locate urban agriculture within urban planning, climate adaptation, and resilience strategies. The Discussion below interprets these findings, situates them within the broader theoretical frameworks introduced in the Literature Review, and articulates the conceptual contribution of the paper.

Interpreting the Multidimensional Character of Urban Agriculture

The Results confirm the central premise of this paper: urban agriculture is no longer adequately captured by its historical framing as a food-production activity. Pradhan et al.'s decomposition of the field into 11 themes and Orsini et al. (2020),

show typology of multifunctional functions together suggest that the multifunctionality of UA is not a rhetorical flourish but an empirically regular feature of the practice. Importantly, the forms through which this multifunctionality is realized, small-scale ground-based plots, building-integrated systems, urban livestock, peri-urban land cover, vary widely across cities, climates, and governance regimes (Pradhan et al., 2023). The implication, consistent with Artmann and Sartison (2018) assessment, is that any analytical framing of UA that reduces it to a single function will systematically understate both its contribution to urban systems and the conditions under which it can deliver that contribution. The paper's central argument that UA should be understood as a form of adaptive urbanism—therefore builds on a robust empirical foundation in which multifunctionality is the norm, not the exception.

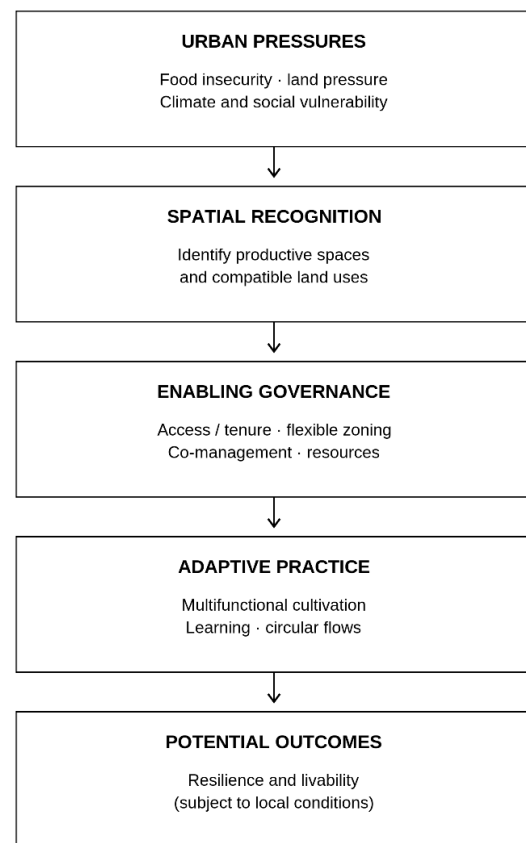


Figure 1. Proposed Transformation Pathway from Urban Agriculture to Adaptive Productive Green Infrastructure (Authors Conceptual Synthesis)

Reconceptualizing Urban Agriculture as Productive Green Infrastructure

A second interpretation concerns UA's positioning within urban green infrastructure networks. The patterns identified in the Results indicate that UA is most effective as a contributor to urban livability and resilience when deliberately networked into UGI planning. Jones et al.'s typology demonstrates that multifunctional GI performance requires a portfolio of feature types (gardens, parks, allotments, city farms, constructed and hybrid GI) operating in combination (Jones et al., 2022); Evans et al. (2022) review finds that the highest ecosystem-service returns emerge precisely where UA is combined with other GI forms, not in isolation; and Korkou et al. (2023), argue that multifunctionality is a prerequisite for impactful UGI planning rather than a by-product. Halting the language of "urban agriculture" alongside "urban green infrastructure" therefore obscures what the literature increasingly recognizes: the two are entwined operational expressions of the same infrastructural logic (Evans et al., 2022; Jones et al., 2022). Positioning UA as productive green infrastructure reconciles its productive and ecological functions and aligns it with the planning instruments, typologies, zoning tools, and ecosystem-service models, through which UGI is governed.

Adaptive Urbanism as an Organizing Lens

The Discussion's principal conceptual move is to bring the three preceding interpretations under a single organizing framework of adaptive urbanism. Adaptive planning scholarship argues that, under conditions of deep uncertainty, planning should shift ambitions from predetermined outcomes toward creating enabling conditions for a range of possible futures (Rauws & De Roo, 2016). Rauws and De Roo (2016), identify non-linear change, self-organization, and responsiveness to the dynamic environment as the defining qualities of such conditions, and they observe that adaptive planning requires institutional arrangements and spatial designs "which support various future configurations while guaranteeing basic rights". UA meets these criteria in concrete form. It is incremental rather than master-planned; it is place-

specific and community-engaged; it adapts to shocks, as the COVID-19 pandemic made visible (Iida et al., 2023; Pulighe & Lupia, 2020), and it produces clusters of co-benefits rather than singular outputs (Orsini et al., 2020; Pradhan et al., 2023). The conceptual contribution of this paper is therefore to argue that UA is not a tool within adaptive urbanism but an empirically observable expression of a set of practices through which adaptive conditions are created in real urban landscapes.

Adaptive Capacities, Livability, and Well-Being

The Results also point to a tighter conceptual coupling between UA, resilience, and livability than is commonly expressed in the literature. The IPCC assessments link UA to both climate adaptation and community cohesion (Intergovernmental Panel on Climate, 2022, 2023). Iida et al. (2023), show that UA in walkable neighborhoods contributed simultaneously to food resilience, health, and biodiversity during COVID-19. Audate et al. (2019) document cumulative effects of UA on physical and mental health and on social capital. Ilieva et al. (2022), highlight community cohesion, dietary improvement, and well-being as the most frequently measured social outcomes; Parker and Simpson (2018), demonstrate that public GI, broadly defined, contributes to city livability through psychological, physiological, and societal pathways. These convergences suggest that the conventional separation in the literature between "resilience" (as a system-level property) and "livability" (as a people-level property) obscures their joint production through practices like UA. By integrating UA into adaptive urbanism, cities can act on both dimensions simultaneously, generating adaptive capacities that are materially grounded in food, green space, social connection, and ecological function.

Comparative Reading of Planning and Governance Context

Singapore, Bangkok, and Rotterdam provide contrasting illustrations of the planning conditions discussed in Figure 1. In Singapore, the literature emphasizes formal land-use planning and interagency coordination in shaping opportunities

for UA (Diehl et al., 2020). This illustrates spatial recognition and institutional support, although formal recognition alone does not demonstrate the long-term viability of individual initiatives. Bangkok highlights a different constraint: legal arrangements and insecure access to land can limit the stability of cultivation activities, even where community interest exists (Chuvongs, 2020). Rotterdam illustrates the relationship between grassroots experimentation and urban ecosystem governance; experimental initiatives can create new practices while still facing challenges of institutional alignment and competing urban development priorities (Cretella & Buenger, 2016; Frantzeskaki & Tilie, 2014). Across the same four analytical dimensions, spatial recognition, access security, institutional coordination, and continuity of practice, the cases suggest that no single instrument is sufficient. Their value lies in illustrating plausible configurations and tensions, not in ranking city performance or proving causal effects.

The conceptual synthesis and comparative analysis suggest that integrating UA into adaptive urban planning requires coordinated spatial, institutional, and operational measures. Municipalities can begin by identifying existing and potential productive spaces within urban green infrastructure inventories and establishing land-use provisions that accommodate UA across public, private, and temporarily available land. These spatial measures should be complemented by transparent and renewable land-access agreements, clear rules for multifunctional and shared-space use, and co-management arrangements involving planning authorities, environmental and food-related agencies, and local communities. Context-sensitive technical support, including water provision, soil safety management, composting, and agricultural extension services, can further strengthen the capacity of UA initiatives to adapt to changing urban conditions. Regular monitoring of land-use continuity, community participation, potential conflicts, food contributions, and ecological co-benefits should inform ongoing planning adjustments. The comparative cases illustrate different priorities within this process. Singapore emphasizes formal spatial coordination, Bangkok highlights the importance of secure land access, and Rotterdam demonstrates the challenges of

connecting community-led experimentation with sustained institutional support. These measures are proposed as context-dependent planning instruments rather than universally applicable solutions or empirically verified policy outcomes.

Circular Economy as a Cross-Cutting Mechanism

The Discussion also highlights the role of circular-economy linkages as an underappreciated axis along which UA contributes to urban resilience and sustainability. The findings from Mendoza Beltrán et al. suggest that circular nutrient flows can yield substantial carbon-footprint reductions in peri-urban agriculture, with implications for both climate mitigation and rural-urban nutrient linkages (Mendoza et al., 2026). Chhour and Carrasquillo (2025) analysis of secondary water and nutrient resources points to a layered logic in which UA simultaneously reduces urban waste streams and builds water- and nutrient-resilient food systems. Riaño-Herrera et al. (2023) and Skar et al. (2019), frame these possibilities within the broader urban metabolism and the water–energy–food nexus. Read together, these findings suggest that adaptive urbanism through UA is not only a buffer in times of shock but also a continuous upgrading of the resource efficiency of the city.

Explaining and Addressing the Persistence of Planning Marginalization

If the case for UA in adaptive urbanism is well-supported, why does it remain marginal in planning frameworks? The Results point to a layered explanation. First, UA sits awkwardly across land-use categories, straddling agriculture, housing, infrastructure, and public space, which complicates its zoning treatment (Alkhaja et al., 2025; Issifu et al., 2025; Onodugo et al., 2022). Second, much of the most vibrant UA activity occurs informally, through actors and tenure arrangements that conventional planning instruments either ignore or, at best, tolerate (Namalwa et al., 2026; Wessels & Mgana, 2024). Third, the planning scholarship has historically prioritized large-scale infrastructural and economic interventions over distributed, community-based forms of urbanism, which is precisely the bias that adaptive urbanism seeks to overturn (Rauws & De Roo, 2016). Alkhaja et al.

(2025), recommendations flexible zoning, UA protection zones, and the active participation of civil actors in planning, constitute a coherent remedial agenda; Issifu et al. (2025), add the specific lever of legislative reform to close gaps in land-use planning frameworks; and Merino et al. (2021), argue for trans-disciplinary, locally led, and multi-sectoral governance models. The takeaway is that the marginalization of UA in planning is not the result of an evidentiary deficit; it is the result of institutional path dependencies that align poorly with the distributed, multifunctional character of UA.

Implications for Theory and Practice

Taken together, the foregoing interpretations yield three broader implications. Theoretically, the paper contributes a tighter coupling between the literatures on urban resilience, urban livability, and adaptive urbanism by showing that these literatures converge most clearly in distributed, multifunctional, productive green practices such as UA. Methodologically, this coupling suggests that future research would benefit from frameworks that score the multifunctional performance of UA across ecological, social, and metabolic dimensions rather than collapsing it into a single function. Practically, the Discussion underscores the value of planning instruments (zoning flexibility, UGI-protected productive typologies, and multi-level governance arrangements) that explicitly accommodate UA not as a residual land use but as productive green infrastructure in adaptive urbanism.

Limitations of the Synthesis

This conceptual synthesis inherits the limitations of its component literatures. Much of the empirical evidence on UA's multifunctional benefits is drawn from case studies of single cities or neighborhoods that are not directly comparable (Iida et al., 2023; Namalwa et al., 2026; Rodríguez et al., 2022). Systematic reviews consistently flag methodological heterogeneity and the need for more rigorous quantitative impact evaluation (Audate et al., 2019; Ilieva et al., 2022). The typology of urban green infrastructure developed by Jones et al. is most applicable to temperate and

humid tropical urban systems and requires adaptation in arid or cold bioclimatic zones (Jones et al., 2022). Several climate-adaptation findings rely on medium- or high-confidence IPCC assessments, which are necessarily aggregated across heterogeneous contexts (Intergovernmental Panel on Climate, 2022, 2023). Finally, by design, this synthesis does not generate primary empirical data, and further empirical work is needed to test the conceptual framework in specific urban settings. The paper therefore positions its contribution as conceptual scaffolding for subsequent empirical investigation rather than as an empirical claim in its own right.

Pathways Forward

Extending this synthesis, future research should pursue three lines of inquiry in particular. First, empirical studies are needed to operationalize the proposed adaptive-urbanism framing of UA in cities of different scales, climates, and governance regimes, including both Global North and Global South contexts. Second, there is scope for integrative assessment frameworks that jointly score UA's contributions to food security, ecosystem services, social cohesion, health, and circular metabolism against an explicit adaptive-urbanism benchmark. Third, comparative governance studies could illuminate which planning instruments, from flexible zoning ordinances and protection zones to multi-level governance agreements, most effectively institutionalize UA within adaptive urbanism.

4. CONCLUSIONS

This paper asked how urban agriculture can function as adaptive productive green infrastructure and which planning conditions enable or constrain that transition. The narrative synthesis indicates that UA's multifunctional food, ecological, social, and circular contributions provide potential pathways to resilience and livability, but their persistence cannot be inferred from cultivation alone. The paper's principal conceptual contribution is a conditional transformation pathway linking spatial recognition, negotiated access, enabling governance, adaptive practice, and locally assessed outcomes, with monitoring and

policy learning feeding back into each stage. Illustrations from Singapore, Bangkok, and Rotterdam underscore different institutional challenges without demonstrating causal policy effects. For planning practice, the framework points to spatial inventories, compatible-use rules, renewable access agreements, co-management, technical safeguards, and monitoring as propositions to be adapted and evaluated. As a narrative conceptual synthesis based on secondary literature, the framework is not an impact assessment and requires empirical testing across diverse urban contexts.

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