

Urban Farming Framework, Benefits for Neighbourhood Development and Urban Sustainability

Albin Mathew¹, Sanu K Thekkath², Sneha N³

^{1,3}M Planning Student, School of Architecture & Planning, Gov. Engineering College, Thrissur, Kerala, India

²Assistant Professor, School of Architecture & Planning, Gov. Engineering College, Thrissur, Kerala, India

Abstract

The paper, "Urban Farming Framework, Benefits for Neighbourhood Development and Urban Sustainability," represents a comprehensive exploration into the imperative need for urban farming and its multifaceted advantages concerning neighborhood development and urban sustainability. Central to its analysis are the elucidation of various forms and definitions of urban farming, underscoring its pivotal role in implementing circular economy strategies and fortifying urban food security measures.

By integrating case studies, particularly within educational institutions like schools and Anganwadi centers, the report underscores the transformative potential of urban farming initiatives in promoting sustainability, community engagement, and equitable participation. Crucially, the study emphasizes the interconnectedness between urban farming and neighborhood development, elucidating how their symbiotic relationship contributes to fostering an inclusive society and advancing sustainable urban design principles. By accentuating the intertwined nature of these elements, the report advocates for a paradigm shift towards holistic urban planning, where urban farming assumes a pivotal role in shaping vibrant, healthy, and resilient neighborhoods.

Ultimately, this comprehensive examination serves as a clarion call for embracing and integrating urban farming as a cornerstone of urban development, fostering not only ecological sustainability but also socio-economic empowerment and community cohesion within urban landscapes.

Keywords: Urban farming, Urban sustainability, Neighbourhood Development, Community engagement, Urban food security.

1. Introduction

Urban farming, a burgeoning movement amalgamating agriculture with the urban landscape, represents a transformative approach to enhancing communities and fostering sustainability within cities. This innovative practice optimizes city spaces for agricultural purposes, yielding multifaceted benefits that resonate throughout neighbourhoods. (M, 2022)

Foremost, urban farming cultivates a robust network for locally sourced produce, mitigating reliance on distant agricultural regions and reducing carbon footprint associated with food transportation. This proximity to fresh, nutritious food not only bolsters community health but also bolsters local economies

by creating employment opportunities and fostering entrepreneurship. Moreover, the cultivation of green spaces engenders a sense of community ownership and cohesion, as residents actively participate in the cultivation and distribution processes, nurturing stronger social ties and engendering a shared sense of purpose. (Yuan, 2022)

Crucially, urban farming significantly contributes to environmental sustainability by ameliorating air quality, reducing heat retention in densely populated areas, and enhancing biodiversity. The presence of greenery in concrete-laden environments mitigates the urban heat island effect, fostering a more temperate microclimate while serving as a habitat for diverse flora and fauna. (Yücedağ, 2023)

2. Literature Review

2.1 Urban Farming

Urban farming is the cultivation, processing, and distribution of food and other agricultural products in urban and suburban areas. It is a sustainable practice that aims to increase access to fresh produce, reduce food miles, and promote community engagement. Urban farming utilizes various techniques such as vertical gardening, hydroponics, and rooftop farming to maximize limited space and resources in urban environments. (Brinkley, 2018)

2.1.1 Types of Urban Farming

Urban agriculture encompasses various types of gardens, including Community Gardens, Backyard Gardens, Rooftop Gardens, Tactical Gardens, Aquaponics, Indoor Farming, Market Gardening, Green Walls, Vertical Farms, Urban Beekeeping, Balcony Gardens, and Window Boxes. Community gardens are shared land plots used for cultivating various plants, while backyard gardens are small plots of land suitable for those with limited space. Rooftop gardens are increasingly popular, offering a variety of plants and utilizing unused space. Tactical gardens are small gardens planted in unexpected locations, often by guerrilla gardeners. Aquaponics and hydroponics combine aquatic plant care, allowing plants to filter fish's water and supply nutrients to plants. Indoor farming is a controlled setting for growing crops that would not thrive in urban climates. Market gardening is the cultivation of fruits, vegetables, and flowers for local markets, allowing farmers to sell their produce directly to customers. Green walls, vertical farms, and urban beekeeping are also popular urban agriculture practices. Balcony gardens, which grow on balconies or terraces, add green space to urban areas.

2.1.2 Benefits of Urban Farming

Urban farming offers a multitude of benefits, including economic advantages for residents through job creation and income generation. It strengthens food security by increasing access to fresh, local produce at lower costs. Beyond just food, urban farms promote biodiversity, provide honey and other bee products, and even reduce noise and air pollution. They create green spaces in urban areas, beautify neighborhoods, and empower small businesses and entrepreneurs. Urban farms can be educational tools for children, promoting healthy eating habits and fostering a sense of community. They contribute to a greener environment by reducing greenhouse gases and offer opportunities for relaxation and connecting with the local community and environment.

2.1.3 Challenges in Urban Farming

Urban agriculture faces several challenges, including poor soil quality, unreliable water supply, the "urban heat island effect," insect pests and diseases, lack of space, and poverty. Poor soil quality, contamination from factories and cars, and unreliable water supply make cultivation difficult. The heat island effect causes higher temperatures, making plants more difficult to grow. Insect pests and diseases are common

in cities, which are less prevalent in rural areas. Despite these challenges, urban agriculture offers opportunities for food production, revenue generation, environmental enhancement, healthful eating practices, and promoting sustainable food production.

2.2 Neighbourhood

The immediate geographic area surrounding a family's home, delineated by environmental physical elements like roads, rivers, railway tracks, and political boundaries. Additionally, neighbourhoods usually have a strong social component that is demonstrated by neighbourly interaction, a feeling of shared identity, and similar demographic traits like socioeconomic status and life stage. (McGuire, 2014)

2.2.1 Neighbourhood as an Unit in Urban Design

In the 1900s, Clarence Perry's concept of a neighbourhood unit in a city aimed to promote community by strategically placing amenities like stores, parks, and schools. This concept has influenced urban planning and continues to influence contemporary design. Urban design studies use neighbourhoods as analytical units to examine physical, social, and cultural components, identifying patterns and benefits for future planning. Community participation is crucial in determining the layout and operation of neighbourhoods.

2.2.2 Characteristics of a Neighbourhood

A neighborhood's boundaries can be physical, such as streets or parks, or social, such as shared identity, social networks, and mixed-use development. These boundaries can be informal or formal, and can be based on shared perceptions or administrative divisions. Social networks, such as parks and gatherings, promote a sense of belonging and community. Mixed-use development, which blends residential, commercial, and institutional spaces, creates a dynamic setting that meets local needs. Walkability and accessibility can promote active lifestyles and reduce dependence on cars. Environmental quality, such as green spaces and clean streets, can improve the wellbeing of residents. Economic vitality can support local businesses and create jobs. Cultural diversity and community governance structures can also contribute to a strong sense of place.

2.2.3 Benefits of Neighbourhood Development

Neighbourhood development can improve safety, health, education, and the local economy by enhancing access to parks, leisure centres, and healthy food options. It can also boost the local economy by attracting businesses, generating employment, and raising property values. Additionally, it can create more livable communities by making them bike-friendly, pedestrian-friendly, and transit-oriented. Investments in neighbourhood development can lead to thriving, equitable, and healthy communities.

2.3 Urban Farming and Neighbourhood Development

Urban farming is a crucial aspect of neighbourhood development, offering numerous benefits such as increased food security, economic growth, environmental protection, social involvement, and community pride. Residents can access locally grown produce, boost property values, attract businesses, and create jobs, while also reducing storm water runoff and greenhouse gas emissions.

2.4 Urban Sustainability

Planning, creating, and administering cities in a way that supports long-term ecological, social, and economic well-being is known as urban sustainability. Developing livable, equitable, and adaptable cities is the goal. Sustainable cities minimise pollution, make efficient use of resources, and advance social justice. (Padmavathi, 2022)

2.4.1 Aspects to Urban Sustainability

Sustainable cities promote sustainable transportation, energy use, waste management, water conservation, green spaces, and community engagement. They encourage cycling, walking, and public transportation, use renewable resources, recycle and compost waste, conserve water, and promote active living through participatory planning and decision-making processes.

2.4.2 Benefits of Urban Sustainability

Sustainable cities offer improved quality of life, reduced environmental impact, economic benefits, social equity, and resilience to change. They provide green spaces, cleaner air, water, and healthier food, while reducing pollution and promoting social justice. They also attract businesses and generate employment, strengthening regional economies.

2.4.3 Indicators.

The evaluation framework for urban agriculture involves a performance matrix, which categorizes and arranges data for assessment. The matrix serves as a starting point for discussion and consensus building among experts and participants. The matrix's indicators are interchangeable with proxies, ensuring flexible application in technical or data-related situations. A condensed version of the matrix is presented, and 87 indicators were found for each of the four pillars. The selection of indicators depends on data availability, processing capacity, physical or cultural attributes, and stakeholder consultation. (Tapia, 2021)

Table 2.1 Pillars use to comparative analysis

Sustainability Pillars	Dimensions	Links to SDGs
Environmental resilience and resource efficiency	Climate regulation and energy balance	11, 13, 15
	Soil conservation, restoration and reclamation	3, 6, 11, 12, 15
	Water management	6, 11
	Reduction of food packaging	11.12
	Green technology innovation	9
Inclusive society	Community engagement and participation	3, 11, 12, 16
	Social capital: diversity, interactions and relationships	5, 10
	Wellbeing: connection to culture and environmental stewardship	3, 11, 13
Food security and income generation	Food provision	2, 12
	Food safety	3, 14, 15
Sustainable urban design	The farming as an element of the urban structure	11
	The farming in relation to other elements of the urban structure	11
	The farming from an institutional perspective	11

Source: Sustainable Cities and Society 74 (2021) 103130

3. Case Studies

3.1 New York City, USA

3.1.1 Environmental Resilience and Resource Efficiency

Urban farms and community gardens collect rainwater for irrigation and storm water management. The Water Resources Group, established in 2001, promotes water conservation. Over 140 community gardens

collect over 5.67 million liters of rainwater annually. Each farm/garden averages 21.5 liters of rainwater harvesting efficiency per roof square foot. Farms and gardens invite locals and restaurants to drop off organic materials for composting. These programs contribute to decreased landfill waste.

3.1.2 Inclusive Society

Some gardens (e.g., Center for Family Life & Healthy Choice) track participant moods. Records show a positive emotional change - from anxious/angry to happy/peaceful - after spending time in the gardens.

3.1.3 Food Security and Income Generation

Eight urban farms and gardens have varying annual harvest totals. While harvest weight increased by an average of 330 kg, overall production remains modest. Similar to harvest counts, market sales per year are not significant contributors to the city's food market. Sales range from hundreds to thousands of dollars, highlighting differences in production scale and output channels.

3.1.4 Sustainable Urban Design

Urban farming in New York City demonstrates how sustainable design principles can be implemented in a challenging urban environment. By creating green spaces, managing stormwater, promoting biodiversity, and fostering community engagement, these initiatives contribute to a more livable and resilient city. (Cohen, 2012)

3.2 Curitiba, Brazil

3.2.1 Environmental Resilience and Resource Efficiency

While a formal program isn't in place, community gardens promote decentralized composting techniques, reducing reliance on city resources for waste management.

3.2.2 Inclusive Society

Community gardens foster social interaction and connection among residents, strengthening community ties. Volunteer work within the gardens provides opportunities for social interaction and a sense of ownership.

3.2.3 Food Security and Income Generation

Community gardens promote food security by providing access to fresh, locally-grown produce without pesticides. The "Horta do Chef" program connects gardens with restaurants, generating income for gardeners and increasing access to diverse vegetables for restaurants. Dependence on city funding limits self-sufficiency of some gardens. Expansion of the program may strain the ability to maintain current support levels for individual gardens.

3.2.4 Sustainable Urban Design

Curitiba's community gardens exemplify how sustainable design can be integrated into urban planning. By creating green spaces, promoting biodiversity, managing storm water, and fostering social connections, these gardens contribute to a more livable and environmentally conscious city. (Machado, 2020)

3.3 Delhi Urban Farming Collective, Delhi

3.3.1 Environmental Resilience and Resource Efficiency

Blocked canals and tube wells create water scarcity for urban farmers, forcing reliance on sometimes poor-quality tube well water. Delhi's water-stressed environment and declining groundwater table discourage farming. Urban farming practices should be integrated into city resilience plans for heatwaves and flash floods.

3.3.2 Inclusive Society

Migrant workers bring valuable skills and experience to urban farming, often finding better wages and working conditions compared to rural areas.

3.3.3 Food Security and Income Generation

Lack of land ownership and demolition of farmlands by the Delhi Development Authority (DDA) discourages investment in new farming techniques. The proposed splitting of Zone O allows farming only in Zone O-I, raising concerns about evictions in the other zone. Farmers face financial strain due to: Unsubsidized agricultural inputs, Weather-related losses & Lack of power connections. Many land-owning farmers struggle to sell produce in Delhi due to the absence of a Minimum Support Price (MSP) and limited government procurement.

3.3.4 Sustainable Urban Design

While challenges exist, urban farming in Delhi presents an innovative approach to sustainable urban design. By creating green spaces, promoting waste management, and encouraging water conservation, these efforts contribute to a more resilient and environmentally conscious city. (Diehl, 2015)

3.4 Chennai Urban Horticulture and Rooftop Gardening Initiative

3.4.1 Environmental Resilience and Resource Efficiency

Increase green cover and reduce urban heat island effect. Conserve water through drip irrigation. Reduce waste through composting and segregation.

3.4.2 Inclusive Society

The program promotes environmental awareness, health, and social responsibility among students in Corporation schools and Anganwadis (childcare centres). Aims to influence 2.5 million citizens by 2030 through education and outreach.

3.4.3 Food Security and Income Generation

The Chennai initiative demonstrates how urban agriculture can contribute to food security by increasing access to fresh produce. With further development, it has the potential to become a source of income generation for residents.

3.4.4 Sustainable Urban Design

The initiative promotes rooftop gardens to increase green spaces within the city. Can contribute to improved air quality and potentially mitigate the urban heat island effect. Low civic consciousness and resident opposition need to be addressed. Water scarcity and quality pose challenges for rooftop gardening. (Sebastian, 2023)

4. Analysis & Inference

Table 4.1 Analysis of practises supporting sustainability pillars From case studies

Sustainability Pillars	Dimensions	New York	Curitiba	Delhi	Chennai
Environmental resilience and	Climate regulation and energy balance	Present	Present	Absent	Absent

resource efficiency	Soil conservation, restoration and reclamation	Present	Present	Absent	Present
	Water management	Present	Present	Absent	Present
	Reduction of food packaging	Present	Present	Absent	Absent
	Green technology innovation	Present	Present	Present	Present
Inclusive society	Community engagement and participation	Present	Present	Present	Present
	Social capital: diversity, interactions and relationships	Present	Present	Present	Present
	Wellbeing	Present	Present	Present	Present
Food security and income generation	Food provision	Present	Present	Present	Present
	Food safety	Present	Present	Present	Present
Sustainable urban design	The farming as an element of the urban structure	Present	Present	Absent	Absent
	The farming in relation to other elements of the urban structure	Present	Present	Absent	Absent
	The farming from an institutional perspective	Present	Present	Present	Present

4.1 Inference

Urban farms are economically and environmentally sustainable, with lower transportation costs. Political stability and support are crucial for their success. Integrating urban farms into low-income areas can advance SDG 11. A coalition of food justice groups, local legislators, and eateries can support these farms, leading to positive interactions and improved psychological characteristics.

4.2 Identified Area of Problems From Study

Urban land accessibility, potential uses, and inclusivity are key factors in addressing water scarcity, inadequate infrastructure, and food security. Community institutions, waste, and lack of education contribute to urban poverty and inequality. Sustainable practices like watershed management, rainwater harvesting, and integrated development can help reduce these issues.

5. Recommendations

5.1 Environmental Resilience and Resource Efficiency

5.1.1 Access to Land

The decline in crop agriculture in urban and peri-urban areas is primarily due to insecurity in land access, posing a risk to farmers and necessitating formal land use planning status.

5.1.2 Water Management Plans

Water authorities should incorporate urban farming and irrigation water use in their water management plans, involving consultation with registered urban farming practitioners and land units.

5.1.3 Infrastructure Development

Urban agriculture and food production should be integrated into urban infrastructure projects, promoting the concept of 'edible city' and encouraging beekeeping and small-scale animal rearing.

5.1.4 Comprehensive Strategy to Eliminate Waste.

Cities generate thousands of tons of garbage daily, including vegetable waste, fruit peels, animal dung, liquid waste, and straw. A comprehensive strategy should eliminate waste, consider agriculture waste, and increase soil fertility.

5.1.5 Energy Source

Agricultural waste can be transformed into nutrient-rich compost, improving soil fertility and structure, and used for irrigation, preventing soil contamination, and converting flammable gases into energy.

5.1.6 Small Compost

The government should integrate vegetable gardening in residential buildings with kitchen waste management, promoting small composting technologies for recycling kitchen waste for gardening. This will reduce waste at the source and promote circularization of resources, making composting a crucial part of land resource management.

5.1.7 Rainwater Harvesting

Rainwater harvesting in conjunction with farming should be promoted. Links should be drawn with existing central and state-level schemes/programmes.

5.2 Inclusive Society

5.2.1 Inclusive Land

A public scheme could allocate limited, long-term public land plots to individuals and citizen groups, particularly women and marginalized castes, for food cultivation.

5.2.2 License-Based System

Land trusts should be formed to manage urban agricultural activities on communal lands, promoting land reform and license-based systems to secure farmlands and infrastructure for disadvantaged individuals.

5.2.3 Community Institutions

Community farming, including small-scale practices in schools, old age homes, and resident associations, utilizes open spaces and unutilized land for vegetables, poultry, and animal husbandry.

5.2.4 Public Health

Educational campaigns involving local civil society groups and social movements can promote urban agriculture, creating supportive public discourse. Government and non-government agencies can also run campaigns for public health, environment, and livelihood.

5.2.5 Address Disparity

Currently, most home food gardening in cities are limited to high-income groups. Low-income groups do

not have the financial capability and support system to grow vegetables in their households. Special efforts need to be taken to address this disparity.

5.2.6 Ministry of Agriculture

Governments should create a separate Ministry of Agriculture which will have a responsibility to take care of urban and peri-urban farming in all its diverse forms.

5.2.7 Ward committees

Ward committees should identify urban farming opportunities and serve as local resource centers. Separate urban farmer associations can be formed, with ex-officio committee members representing these associations.

5.2.8 Urban Farming Commission

An 'Urban Farming Commission', comprising experts from various sectors, should be established to offer expert advice to decision-makers at state and ward levels.

5.2.9 Advertisements and Campaigns

Adopting decentralized household-level sewage management requires knowledge, technical skills, and financial support, with funds allocated for advertising and campaigns to promote its effectiveness and social benefits.

5.2.10 NGOs

Initiatives by NGOs" can be utilised and encouraged to provide training on a neighbourhood scale and develop community initiatives of waste-to-food programmes in various informal settlements understanding the food system.

5.2.11 Regional and Global Exchange of Ideas

A public forum should be established at activity and state levels to facilitate regular discussions, dialogues, seminars, and events on urban farming, promoting regional and global knowledge exchange.

5.2.12 Conduct Participatory Scientific Research

Higher education institutions should encourage participatory research on urban agriculture, with state governments initiating grant and fellowship programs. Researchers should work interdisciplinary, involving grassroots movements, citizen initiatives, and farmers' unions, to advance urban agriculture.

5.2.13 Appropriate Measures to Address Urban Poverty

The government should enhance local food systems to meet food security and nutrition needs, including urban farming, which provides livelihoods and reduces food expenses, and residential and community kitchen gardens, which improve nutritional status for all income groups.

5.2.14 Programmes for Inequality Reduction

Urban farming should be incorporated into programmes for inequality reduction, urban regeneration, housing schemes, support for small enterprises, skills development programmes, local area development, school education, mid-day meal, nutrition and other public health campaigns.

5.2.15 Integrated Development

Mission for Integrated Development Horticulture provides incentives to shift to vegetable/fruits/flower production as there is a ready market for which supply chains can be integrated and thus help reduce food miles.

5.3 Food Security and Income Generation

5.3.1 Food Security

Urban residents are using rooftop, terrace, backyard, and vertical spaces to grow vegetables and keep

animals, particularly for low-income households in 'unauthorised colonies' and slum settlements, as survival strategies.

5.3.2 Farming Kits

Urban farmers require unique support, including access to quality seeds and fertilizers, and enhancement of knowledge and technical skills. A free distribution of farming kits, including tools, seeds, compost, and technical knowledge manuals, could be initiated, monitored for effectiveness.

5.3.3 Additional Supports and Subsidies

The scheme can be expanded to include additional subsidies for access to fertile land, irrigation infrastructure, water supply, sheds, fencing, and pest and weed management knowledge.

5.3.4 Organic Produce at Affordable Prices

Methods and increase their confidence in organic farming.

5.3.5 Creating Accessible Local Markets

Initiatives like weekly or farmers' markets should be implemented to connect farmers and consumers, especially for women farmers, ensuring fair recognition and pay in agriculture

5.3.6 Storage Facilities

Developing appropriate storage facilities is a must to facilitate urban farming and ensure consistent and fair income for the farmers.

5.4 Sustainable Urban Design

5.4.1 Potential Usages of a Plot of Urban Land

Urban farming encompasses various practices such as crop farming, poultry, dairy, agroforestry, beekeeping, and emerging techniques like hydroponics, utilizing urban land for various purposes.

5.4.2 Incentives

Urban farmer associations can use vacant public land for agricultural purposes, while fiscal incentives can also encourage people to use vacant private land for agriculture.

5.4.3 Curriculum

Schools are integrating farming into curriculums, promoting food literacy through school-based interventions that involve children engaging in farming, interacting with local farmers, and understanding the food system.

5.4.4 Mid-Day Meal

In schools, farming activities can be integrated with the mid-day meal schemes to make the mid-day meal programme even more effective and participatory, where children learn about the food they grow and decide how they want to consume it.

5.4.5 Efficient Watershed Management

Urban and peri-urban forestry practices should be promoted as they can help build resilience against the events of intense urban flooding. Urban and agro forests would contribute to efficient watershed management, safeguarding water catchment and reducing runoff and erosion in cities.

5.4.6 Campaigns to Promote the Adoption of Agro Ecology

Policy assurances and campaigns should be announced to encourage farmers to adopt agro ecology, promoting genetic diversity, planting diversity, intercropping, mulching, and creating habitats for flora and fauna. Municipal committees can provide training to farmers.

5.4.7 Building Codes

The National Building Code 2016 includes vertical landscaping and rooftop gardens for energy conserva-

tion and cooling. Urban farming can reduce heat effects by 2-3 degrees, and building codes and certifications must support tree shade and vegetation.

5.4.8 Urban agro-service centres

Urban agro-service centres should support farmers in adopting agro ecological cultivation methods and popularizing small-scale building-integrated production on rooftops and balconies, providing inputs and technical services.

5.4.9 Ecologically Sustainability

Urban agriculture can contribute to urban sustainability by systematically adjusting lease arrangements, providing market access, subsidies for agricultural inputs, and financial incentives for agro ecology, as seen in Kerala and Odisha, and transforming waste and surplus heat into useful inputs.

6. Conclusion

The paper "Urban Farming Framework, Benefits for Neighbourhood Development and Urban Sustainability" highlights the importance of urban farming in neighbourhood development and urban sustainability. It highlights its role in circular economy strategies, urban food security, and community inclusivity. The report advocates for a shift in urban planning, highlighting the transformative power of urban farming in fostering vibrant, healthy, and resilient neighborhoods. Case studies from educational settings demonstrate its potential.

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