ISSN XXXX-XXXX

COMPARATIVE STUDY OF URBAN FARMING PRACTICES AROUND THE WORLD: EFFORTS TO SUPPORT FOOD SECURITY AND ENVIRONMENTAL CONSERVATION

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Abstract

Accelerated urbanization, climate crisis, and increasing food insecurity in various parts of the world have prompted cities to seek innovative strategies to ensure the sustainability of food systems while preserving the environment. One approach that is increasingly being adopted is urban agriculture, which combines food production with ecosystem services. This study conducts a comparative analysis of various urban agriculture practices in seven countries—Iran, the United Kingdom, Argentina, South Korea, Singapore, Zimbabwe, and New Zealand—to assess their impact on food security and environmental conservation. Each region has different forms of practices such as community gardens, rooftop gardens, vertical farming, permaculture, and community agroecology, which are implemented to enhance social solidarity, community empowerment, energy efficiency improvements, and food sovereignty. Government support varies from weak to very strong, with Singapore and South Korea providing comprehensive policy interventions, while Zimbabwe and Iran tend to rely on community-led initiatives. Contributions to food security are particularly notable in regions with high food vulnerability, such as Iran and Zimbabwe, as well as through national-scale food security strategies, such as in Singapore. On the other hand, contributions to environmental conservation include the provision of public green spaces, climate change mitigation, urban heat island cooling, carbon sequestration, water and soil resource conservation, and biodiversity enhancement. This study employs a qualitative approach using a comparative study method based on literature review. Data were collected from various scientific publications, policy reports, and relevant case studies, then analyzed to identify similarities, differences, and success factors of urban agriculture practices in each country. The analysis focused on the relationship between the form of practice, the level of policy support, and its impact on food security and environmental sustainability. The findings of this study confirm that the effectiveness of urban agriculture is determined by the alignment of practice forms with the local context, adequate policy support, and its integration into sustainable development strategies, thereby functioning as a strategic instrument in building a resilient and environmentally friendly urban food system.

Keywords: urban farming, food security, environmental conservation, public policy, comparative study, sustainable development

INTRODUCTION

Urban farming, such as agriculture in urban areas, has emerged in recent decades as a response to emerging issues such as food security, climate change, and environmental problems in urban areas. Many cities worldwide are struggling to address problems caused by urbanization, such as limited green spaces, coupled with high dependence on the global food supply chain, which is vulnerable to geopolitical conflicts, pandemics, or climate change (Khan et al., 2024; Gatson et al., 2022). Urban farming, in this context, emerges as a nature-based solution that is not merely about providing fresh food in urban areas but also supports sustainable development, biodiversity conservation, and the strengthening of social cohesion needed in increasingly fragmented urban environments (Cabral et al., 2017; Di Pietro et al., 2018).

Urban farming employs various supporting facilities and infrastructure such as rooftop farming, vertical greenhouses, aquaculture, hydroponics, and integration with public green spaces and marginal lands that were previously unproductive (Teoh et al., 2024; Kim et al., 2020). Beyond being a food production strategy, urban farming has also been recognized and developed in social, cultural, and environmental contexts. Communities or social groups are generally not new phenomena and play a role in mental health.

METHODOLOGY

This study uses a qualitative approach with a comparative study method based on literature review. Data was collected from scientific journal articles, policy reports, international institution publications, and case studies relevant to urban agriculture practices in the seven countries that were the focus of the study. The selection of sources was based on the criteria of recency, credibility, and relevance to the topics of food security and environmental preservation. The collected data were analyzed thematically to identify the forms of urban agriculture practices, their main objectives, the level of government support, and their contribution to food security and environmental safety. The analysis was conducted by comparing similarities and differences between countries and examining the factors that influence the successful implementation of each practice in the local social, economic, and ecological contexts.

RESULTS AND DISCUSSION

Global Urban Farming Development

Urban farming has grown rapidly in recent decades in response to challenges related to food security, climate change, and environmental degradation in urban areas. Cities around the world face pressures from rapid urbanization, limited green spaces, and high dependence on global food supply chains that are vulnerable to disruption by geopolitical conflicts, pandemics, and climate disasters (Khan et al., 2024; Gatson et al., 2022). In this context, urban farming emerges as a nature-based solution that not only provides a source of fresh and nutritious local food but also contributes to sustainable development, biodiversity conservation, and the strengthening of social cohesion in urban environments that tend to be fragmented (Cabral et al., 2017; Di Pietro et al., 2018).

Urban farming practices encompass various forms such as community gardens, rooftop farming, vertical greenhouses, aquaponics, hydroponics, and integration with green open spaces and previously unproductive marginal lands (Teoh et al., 2024; Kim et al., 2020). Beyond being a food production strategy, urban farming also has significant social, cultural, and ecological dimensions. Community gardens, for example, have been shown to improve mental health, strengthen social networks among residents, and foster intergenerational ecological awareness (Gray et al., 2022; Hou, 2017; Sharif & Ujang, 2021). In some contexts, urban farming even plays a political role in promoting food sovereignty, advocating for the right to urban space, and fostering forms of "quiet activism" through daily citizen participation (Kanosvamhira & Tevera, 2024; Ghose & Pettygrove, 2014).

Major cities such as Singapore, Seoul, Rosario, London, and Berlin have adopted urban farming in their spatial planning policies, food security strategies, and as a tool for climate change mitigation (Lucena & Massuia, 2022; Park & Ahn, 2013; Couretot et al., 2022; Caputo et al., 2023; Seitz et al., 2022). However, the success of these practices heavily depends on the social-political context, institutional support, community capacity, and available technological innovations (Nicholas et al., 2023; Wesener et al., 2025). In some regions, these practices emerge from grassroots movements as a response to economic crises or social marginalization. In other regions, urban farming is actively promoted by governments as part of strategies for smart, resilient, and competitive city planning (Sia et al., 2023; Low, n.d.).

Urban farming encompasses various forms of agriculture in urban environments such as community gardens, rooftop gardens, vertical farming, and micro-agriculture. This concept goes beyond mere food production, as it also encompasses social, ecological, and economic values.

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Cabral et al. (2017) emphasize that urban gardens are multifunctional, nature-based solutions to address various social objectives, such as well-being, community connectivity, and climate adaptation.

Additionally, Khan et al. (2024) and Teoh et al. (2024) state that urban farming can reduce the carbon footprint of food transportation, improve resource efficiency, and strengthen community resilience to global food system shocks. In this context, urban farming is not merely a form of food production but an integral part of the city's ecological and social system.

Global Urban Farming Case Studies

Tehran, Iran

Asl and Azadgar (2022) studied the spatial distribution of community gardens in Tehran and found that this practice is strongly correlated with residents' socioeconomic status. In more affluent areas, community gardens are more organized, productive, and supported by local policies. However, in low-income areas, the existence of community gardens is more driven by subsistence needs and social solidarity.

The implication is that urban farming functions as a mechanism for socio-economic adaptation, but access to it is not yet fully equitable. Urban planning needs to be more inclusive so that the benefits of urban farming can be felt by all segments of society. As stated by Ghose and Pettygrove (2014), urban farming spaces in cities function as places for articulating citizenship and the right to the city, especially for marginalized groups with limited access to urban resources.

Additionally, Egerer et al. (2024) highlight the importance of maintaining the autonomy and flexibility of community gardens to create spatial and ecological justice. Without supportive policies, community gardens risk becoming short-term projects eroded by commercial pressures and evictions. This is particularly relevant in Tehran, where infrastructure development and land needs often overlook the social-ecological value of community gardens.

Thus, urban farming in Tehran not only reflects adaptive strategies to food insecurity but also becomes an arena for the struggle for the right to space, ecological justice, and recognition of local knowledge in urban development.

United Kingdom

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A study by Caputo, Schoen, and Blythe (2023) shows that community gardens in the United Kingdom are highly productive despite being managed on a voluntary basis. In some cases, community gardens can produce more than 1.5 kg of food per square meter per growing season, demonstrating significant potential in supporting community-based local food systems. This is also supported by a study by Lin et al. (2024), which highlights the significant contribution of community gardens to food production in urban areas, although the distribution of benefits is not always equitable among the communities involved.

However, the main challenges faced are financial sustainability and a lack of policy support from local governments. Clarke et al. (2019) note that urban farming in the UK is still considered a marginal activity in city policies, despite its significant adaptive potential to climate change, such as increased water absorption and reduced heat island effects. The lack of integration into urban planning systems means that many community garden projects rely on donors or self-help efforts that are vulnerable to disruption.

Wesener et al. (2020) also emphasize the importance of the "placemaking" aspect in the development of community gardens in Europe, including the UK. The success of community gardens does not only depend on productivity but also on their ability to create inclusive public spaces, strengthen social networks, and provide safe spaces for residents to gather and learn.

Thus, the case study from the UK shows that productive urban farming is not enough without structural policy support that facilitates access to land, long-term security, and integration into the local food system. The ecological and social potential of community gardens must be recognized as part of the essential urban infrastructure in addressing food and climate crises.

Rosario, Argentina

In Rosario, Argentina, urban farming has evolved into part of a social movement rooted in agroecological principles. Couretot et al. (2022) note that this practice is not only oriented toward food security but also intended to address social inequality and strengthen the economy of marginalized communities. The program is led by the city government in collaboration with civil society organizations, providing agroecology training, access to fallow land, tool assistance, and free seed distribution to urban farmers. This policy enables the transformation of urban spaces into productive land while expanding citizen participation in the local food system.

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South Korea

South Korea has adopted an integrated, policy-based approach to the development of urban farming, particularly rooftop gardens in densely populated urban areas such as Seoul. Kim et al. (2020) show that rooftop gardens designed within the context of green building policies can reduce surface temperatures by up to 3°C, contributing to heat island mitigation and building energy efficiency. Park and Ahn (2013) add that the South Korean government actively promotes urban farming as part of its sustainable urban development strategy, through the provision of incentives, the formulation of supporting regulations, and the provision of technical training for residents.

Experiments such as those conducted at the SAHA Disabled Welfare House (Kim et al., 2012) illustrate how urban farming also functions as a medium for social empowerment, particularly for vulnerable groups such as people with disabilities. In this project, the rooftop garden not only served as a space for food production but also as a social and psychological space that supported the process of recovery and social integration. This highlights the significant potential of urban farming in therapeutic and inclusive functions, expanding its benefits beyond purely economic and environmental aspects.

Furthermore, Clarke et al. (2019) emphasize that progressive urban farming policies like those in South Korea demonstrate how state interventions can create collaborative opportunities between the public sector, local communities, and the education sector. This approach is also aligned with the nature-based solutions framework recommended in global climate change adaptation policies.

Thus, South Korea serves as an example of how urban farming can be strategically integrated into urban governance while still allowing space for social experiments that strengthen inclusion, mental health, and the resilience of urban communities.

Singapore

Singapore is one of the countries that has adopted the most integrated and high-tech approach to urban farming practices. Nicholas et al. (2023) and Sia et al. (2023) note that the Singaporean government actively integrates vertical farming, hydroponics, and aquaponics into urban infrastructure, including government buildings, community centers, and public facility rooftops. This approach aligns with Singapore's national target of achieving 30% local food production by 2030 as part of efforts to reduce import dependency and enhance national food

security. Rosario's agroecology model emphasizes a holistic approach to urban agriculture, including biodiversity protection, soil conservation, and the production of healthy food without chemical pesticides. This aligns with the findings of Jordi-Sánchez and Díaz-Aguilar (2021), which show that urban farming practices in some Latin American regions contribute to the construction of organic food systems based on community values and sustainability.

Urban farming in Rosario also exhibits a strong ecological activism, where city residents use farming practices as a way to reclaim public space and advocate for food justice. In line with the views of Kanosvamhira and Tevera (2024), this form of urban farming reflects "quiet activism"—a form of resistance manifested in the daily actions of residents in building food sovereignty. The case of Rosario shows how urban farming can transform from a mere survival strategy into an instrument of socio-political change, addressing issues of social exclusion and opening up space for more equitable, participatory, and sustainable food governance. Lucena and Massuia (2022) emphasize that urban farming in Singapore serves not only as a food source but also as a strategy for carbon emission reduction, energy efficiency, and climate change adaptation. This high-tech urban farming system is designed to be water-efficient, low-waste, and have a low carbon footprint. For example, the use of closed-loop systems in hydroponic farming allows for efficient circulation of water and nutrients without environmental contamination.

Low's study (n.d.) shows that Singapore's success is inseparable from strong government policy support, ranging from financial incentives, spatial regulations, to the development of an agritech innovation ecosystem. The government also encourages private and startup participation in the development of urban farming systems, making this sector an integral part of the national green economy strategy.

Despite its high-tech nature, urban farming in Singapore also targets the social dimension through education and community engagement programs, such as vertical community gardens in HDB housing estates. This reflects the integration of technology, policy, and community participation in creating a resilient and sustainable urban food system. Thus, Singapore stands as a prime example of how a city-state can overcome land and resource constraints through innovative approaches, positioning urban farming as a key pillar of national resilience and the transition toward a low-emission city.

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Aotearoa New Zealand

Research by Wesener et al. (2025) in Christchurch, Aotearoa New Zealand, highlights the importance of spatial dimensions in the success of urban farming, particularly community gardens. They found that the location and accessibility of community gardens significantly determine how much local communities can utilize them for food, education, and social interaction. Urban farming is not only seen as a food solution but also as a "placemaking" strategy—that is, creating meaningful and functional social spaces for urban communities. Community gardens in Christchurch are designed collaboratively between the city government, local organizations, and residents, fostering a sense of ownership, active participation, and community identity formation. This aligns with Hou's (2017) findings on community gardens as multimodal spaces bridging ecological, social, and cultural functions within the urban landscape.

Clarke et al. (2019) also emphasize that urban farming, particularly in the form of community gardens, plays a crucial role in urban climate change adaptation strategies. In Aotearoa, community gardens contribute to rainwater management through natural drainage, create cooler microclimates, and support the presence of local plant and insect species, thereby enhancing biodiversity. The collaborative model in Christchurch demonstrates how urban farming can strengthen social cohesion, reduce inequality in access to green spaces, and support the climate-resilient city development agenda. In this context, urban farming becomes an ecological and social practice that is integrated into urban spatial planning.

Country / Region	Form of Urban Farming	Main Purpose	Government Support	Contribution to Food Security	Contribution to Environmental Security
Iran	Community gardens	Solidarity & survival	Limited	High in low-income areas	Green spaces and clean air
United Kingdom	Community gardens	Food production & social	Moderate	Significant, community-based	Green infrastructure and climate mitigation
Argentina	Community agroecology	Empowerment & justice	Strong (local)	Alternative to industrial food systems	Soil regeneration and biodiversity
South Korea	Rooftop gardens	Aesthetics & energy efficiency	Strong	Efficient, limited scale	Urban cooling and carbon absorption
Singapore	Vertical farming	National food security	Very strong	Strategic and sustainable	Circular systems, low emissions
Zimbabwe	Permaculture	Citizens' food sovereignty	Minimal	High in food-insecure areas	Water and soil conservation

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New Zealand	Inclusive community gardens	Social rehabilitation	Strong (local)	Fair and inclusive	Natural drainage and public green spaces

Impact on Food Security and Environmental Conservation

Urban farming is increasingly seen as a multifunctional strategy capable of addressing the challenges of urbanization, environmental degradation, and food security in various parts of the world. As urban populations grow, space for food production becomes increasingly limited, while the impacts of climate change demand more adaptive and sustainable food systems (Khan et al., 2024). This analysis compares seven case studies from Iran, the United Kingdom, Argentina, South Korea, Singapore, Zimbabwe, and New Zealand, each of which has developed different forms of practice, objectives, and policy support, yet shares a common effort to enhance food security while preserving the environment.

In Iran, community gardens are a vital resource for low-income urban communities. Research by Asl and Azadgar (2022) shows that the distribution of community gardens in Tehran tends to be concentrated in poor areas and functions as a survival strategy amid limited access to food and green spaces. Government support is relatively limited, so the sustainability of this practice depends heavily on community solidarity. In addition to being a food source, these gardens also provide a space for social interaction that reduces urban social isolation (Ghose & Pettygrove, 2014).

In the UK, community gardens have long been part of the urban landscape, serving a dual function as food production spaces and social activity centers. Caputo et al. (2023) found that community gardens in the UK can achieve high production efficiency when managed collectively, despite generally small production scales. The government provides moderate support, primarily through green infrastructure programs and climate mitigation policies (Cabral et al., 2017). Additionally, community gardens play a crucial role in climate adaptation by enhancing soil permeability and mitigating the urban heat island effect (Clarke et al., 2019).

Argentina stands out for its community agroecology approach, particularly in Rosario, Santa Fé. Couretot et al. (2022) note that this program was pioneered by local governments to empower poor communities through the production of healthy, chemical-free food. Agroecology not only contributes to food security but also restores soil fertility and increases

biodiversity (Di Pietro et al., 2018). This approach also serves as an alternative to industrial food systems that tend to be exploitative and contribute to social injustice.

South Korea has developed rooftop gardens as a solution to land scarcity in densely populated cities. Research by Kim et al. (2020) shows that rooftop gardens in Seoul can reduce building surface temperatures by up to 5°C, leading to reduced energy consumption for cooling. With strong policy support (Park & Ahn, 2013), rooftop gardens in South Korea combine aesthetic functions, energy efficiency, and limited-scale food production. Kim et al.'s (2012) study also highlights the social potential of rooftop gardens, particularly in enhancing inclusivity and community interaction.

Singapore serves as an extreme example of state support for urban agriculture, with its "30 by 30" policy aiming to produce 30% of domestic food needs by 2030 (Low, n.d.; Lucena & Massuia, 2022). High-tech vertical farming is the backbone of this strategy, combining space efficiency, hydroponic systems, and carbon emission reduction. Nicholas et al. (2023) emphasize that strong policy support enables Singapore to integrate urban farming into its national food security strategy while also fostering a low-emission circular system (Sia et al., 2023).

Zimbabwe relies on permaculture systems to support food sovereignty in food-insecure regions. Limited government support has driven communities to leverage local knowledge in managing water and land sustainably (Kanosvamhira & Tevera, 2024). Permaculture has proven adaptive to dry climatic conditions and contributes to natural resource conservation. This practice shows that community-based interventions can remain effective even without state support, as long as they have social legitimacy and are appropriate to the local context.

In New Zealand, inclusive community gardens are developed with a focus on social rehabilitation and inclusion of marginalized groups. Wesener et al. (2025) revealed that the location of community gardens in Christchurch was strategically designed to ensure high accessibility for all residents. Strong local government support aims to expand the function of gardens as green public spaces, natural drainage systems, and environmental education centers. Wesener et al.'s (2020) study also emphasizes that the success of community gardens in New Zealand is greatly influenced by placemaking and community participation.

In general, contributions to food security in these seven countries can be grouped into two main categories. First, increasing food availability in food-insecure regions, such as in Iran and Zimbabwe, where urban farming serves as a social safety net (Modibedi et al., 2021;

Kusumanagari & Ellisa, 2021). Second, national strategies to reduce import dependency, such as in Singapore, where vertical farming technology is used to meet strategic food needs (Teoh et al., 2024).

Contributions to environmental conservation also vary. In countries like the United Kingdom, New Zealand, and Iran, urban farming provides green spaces that improve air quality and support biodiversity (Seitz et al., 2022). In South Korea, rooftop gardens help mitigate climate change and reduce the urban heat island effect (Kim et al., 2020). In Argentina and Zimbabwe, agroecology and permaculture play a role in soil and water conservation (Couretot et al., 2022; Kanosvamhira & Tevera, 2024). Meanwhile, vertical farming in Singapore reduces carbon footprints through the optimization of food supply chains (Lucena & Massuia, 2022).

This analysis shows that strong policy support accelerates technology adoption and expands production scale, as seen in Singapore and South Korea. However, community-based approaches without significant support can also succeed if they align with local needs, as seen in Zimbabwe and Iran. Other success factors include active community involvement (Hou, 2017; Sharif & Ujang, 2021), access to production resources, and the ability to adapt to local socio-economic conditions (Egerer et al., 2024).

From a policy perspective, integrating urban farming into urban planning and national food security strategies will strengthen the resilience of urban food systems to external shocks. Cross-border knowledge exchange also has the potential to accelerate the adoption of best practices relevant to local contexts (UCLG-ASPAC, n.d.). Thus, despite differences in form, objectives, and levels of government support, urban farming practices in these seven countries demonstrate that a combination of technical innovation, community participation, and policy support can create urban food systems that are both resilient and environmentally friendly.

Conclusions and Recommendations

A comparative study of seven urban farming practices in Iran, the United Kingdom, Argentina, South Korea, Singapore, Zimbabwe, and New Zealand shows that urban agriculture has a dual strategic role: improving food security and contributing to environmental conservation. The varied forms of practice—ranging from community gardens, agroecology, rooftop gardens, permaculture, to vertical farming—show that there is no single universal model. The success of implementation is greatly influenced by the suitability of the approach to the local

social, economic, and ecological context, as well as the level of policy support. Countries with high policy and technological support, such as Singapore and South Korea, are able to accelerate the achievement of production targets and technical innovation. Meanwhile, community-based approaches in Iran, Zimbabwe, and Argentina demonstrate that active citizen participation and the utilization of local knowledge remain effective even with minimal government support. By combining technological innovation, community engagement, and policy integration into urban planning, urban farming can become a resilient long-term solution to address food and environmental challenges in the era of urbanization and climate change.

To optimize the role of urban farming in food security and environmental conservation, it is necessary to integrate these practices into urban planning so that land provision, supporting infrastructure, and regulations can be ensured sustainably. The government needs to strengthen policy support through incentives, seed and technology subsidies, and regulatory ease for communities and the private sector. Enhancing community capacity through technical training, workshops, and mentoring will help improve skills, efficiency, and production quality. A hybrid approach that combines high technology such as vertical farming and hydroponics with community-based models such as agroecology and permaculture can be a solution to address production challenges while maintaining ecological sustainability. Additionally, multisectoral collaboration between government, academia, businesses, and local communities must be strengthened to optimize research, funding, distribution of outcomes, and technological innovation. Urban farming should also be designed as a climate change adaptation strategy through reducing the urban heat island effect, water conservation, and enhancing biodiversity in urban areas.

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