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REVIEW ARTICLE

A review on urban farming: Potential, challenges and opportunities

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Abstract

Urban farming has emerged as a promising solution to address food security in cities. It encompasses several farming models, such as community, indoor, rooftop, and vertical farms, equipped with various farming techniques like aeroponics, hydroponics, and aquaponics. However, sustainability and yield remain major challenges to fully realize its potential. To gain more insights, we have analysed scientific literature and interviewed urban farmers. Key challenges identified include limited land and water resources, incidences of pests and diseases, financial constraints for setup and maintenance, knowledge and skill gaps among participants, and lack of effective collaboration between universities, government, and industries. This review discusses global initiatives in urban farming, different types of farming models, their benefits and challenges, and explores opportunities to address these challenges. The insights gained from this study will serve as a resource for the establishment of urban farms and the development of strategies aimed at enhancing the sustainability of urban farming.

Keywords

Aquaponics, farming models, food security, hydroponics, sustainability, vertical farming

Introduction

An increase in population, rapid urbanisation, and conversion of arable land into urban architecture are emerging as key challenges for food security in urban areas (Pandey and Seto 2015; Zoomers et al. 2017; Abass et al. 2018). It is estimated that by 2050, about two-thirds of the world's population will live in cities, contributing to rapid urban growth (Gu et al. 2021). Hence, it is essential to establish farms in urban areas to produce food to feed the expanding populations. Urban farming is a modern agricultural practice of cultivating crops, fish, and livestock within urban areas that serve to supply fresh food (Goldstein et al. 2016). It involves the utilisation of limited space in urban areas such as balconies, rooftops, vacant lots, and vertical structures to produce crops and raise animals or fish (De Bon et al. 2010). In addition, urban farming can further improve livelihood options, and create employment opportunities along with contributing to Sustainable Developmental Goals (SDGs) (Somanje et al. 2020). Urban farming can address two important SDGs, which are Zero Hunger (SDG 2) and Sustainable Cities and Communities (SDG 11).

Several studies highlight the benefits of urban farming over traditional agriculture in alleviating negative environmental impacts (Orsini et al. 2013), such as reduced water consumption (Ali et al. 2022) and pesticide usage (Mogk et al. 2010), increasing local food production (Specht et al. 2014), and promoting sustainable living in highly populated urban areas (Haddad et al. 2019). Also, by producing food locally, urban farming can minimise long-distance transportation and thus, reduce the emission of the associated greenhouse gases (Kafle et al. 2023).

In recent years, the global urban farming market has experienced significant growth due to an increase in public awareness of the health benefits of locally sourced organic fresh produce (Eigenbrod and Gruda 2015). The urban farming market size was valued at USD 139064.22 million in 2022 and will reach USD 219151.95 million in 2028, with a Compound Annual Growth Rate (CAGR) of 7.88% during 2022–2028 (Urban Farming Market Overview 2024). The market growth of urban farming is also driven by technological advancement and innovation of several urban farming systems such as vertical farming, hydroponic, aeroponic, or aquaponic systems for year-round food production, and efficient usage of resources such as energy and water (Nwosisi and Nandwani 2018; Chatterjee et al. 2020; Despommier 2020).

Urban farming became increasingly popular since the COVID-19 pandemic which disrupted several supply chains due to movement control orders. Following the pandemic, several urban sites have stepped up for production of food to meet the increasing demand (Nemes et al. 2021). Despite several benefits and post-pandemic upscaling, there are still several challenges in urban farming to achieve sustainability in food production. In this review, we link together information obtained from literature and urban farmers from Malaysia to generate comprehensive information on different urban farming systems and suitable crops, farm inputs, and challenges and strategies to address those challenges.

Urban farming models

There are mainly four types of urban farming models, which are community (Jansma et al. 2024), indoor (Despommier 2013), rooftop (Drottberger et al. 2023) and vertical farms (Parameswari et al. 2024). Different models are used based on the availability of space, resources, and types of produce. The main farming techniques used in these models are aeroponics, hydroponics, aquaponics, and vertical farming. In aeroponics, plants are grown by suspending plant roots in the air and delivering nutrients directly to the roots without soil (Chittibomma et al. 2023), and in hydroponics, plants are grown directly on nutrient-rich water solution (Bilagi et al. 2023). On the other hand, for the aquaponic technique, plants are grown in a closed circulatory system with aquaculture, where the fish waste provides nutrients for plants, and plants purify the water for fish (de Korte et al. 2024). In vertical farming, crops are grown on vertically stacked layers, unlike the single surfaces used in traditional agriculture (Katoch et al. 2024). In several commercial farms, aeroponics, hydroponics, and aquaponics are integrated with vertical farming in the formal modular tower to maximise yields using limited space (Mir et al. 2022). Table 1 outlines different urban farming models with their advantages and limitations.

Table 1. Urban farming models with their advantages and limitations.

Urban farming models	Advantages	Reference	Limitations	Reference
Community farm	Offer a dependable source of fresh, reducing reliance on imported food and mitigating the risk of food shortages during crises.	Yuan et al. 2022; Giyarsih et al. 2024	Limited access to affordable land due to high cost, and restrictive land-use regulations.	Salim et al. 2022
	Serve as hubs for social interaction and cohesion and strengthen community bonds.	Yusoff et al. 2017	Environmental factors such as access to transportation, and socioeconomic status affect community participation.	Mauerhofer 2016
	Restructuring unused land, fostering community development, and enhancing the psychological well-being of residents.	Yusoff et al. 2017	Relying on volunteer labor and donations to cover operational expenses or issue on resource allocation.	Mauerhofer 2016
Indoor farm	Enable year-round production of crops regardless of external weather conditions, ensuring a consistent and reliable food supply throughout the year.	Engler and Krarti 2021	Significant initial capital investment, including costs for climate control systems, lighting, irrigation systems, and technology implementation.	Van Delden et al. 2021
	Eliminates exposure to outdoor pests, significantly reducing the need for chemical pesticides.	Sarwar and Lee 2016	Requires specialized knowledge and technical expertise to effectively manage and operate indoor farming facilities.	Mongia and Ravulakollu 2021
	Precise control of growing conditions, including temperature, humidity, light, and nutrient levels, leads to higher crop yields.	Wong et al. 2020	Relies on technology and automation for monitoring and controlling growing conditions, irrigation, and nutrient delivery.	R Shamshiri et al. 2018
Rooftop farm	Utilizes urban spaces to grow food crops by maximizing vertical space, and provides green space for building occupant.	Hui 2011	Fluctuation in temperature, sunlight, wind, and precipitation.	Caputo et al. 2017
	Enable the production of fresh with strong water management, improve air quality, and urban heat island mitigation	Drottberger et al. 2023	Optimizing plant selection is essential for successful rooftop farming.	Buehler and Junge 2016
Vertical farm	Maximizes space by growing crops in vertically stacked layers, allowing for high-density cultivation in urban areas where land is limited and expensive.	Kalantari et al. 2018	Requires specialized knowledge and technical expertise in areas such as hydroponics, and climate control systems to optimize resources and crop growth.	Katoch et al. 2024
	Enable year-round production of crops regardless external weather condition.	Avgoustaki and Xydis 2020		
	Empower the community members with the knowledge and skills for food production and self-sufficiency, promoting lifelong learning and resilience within the community.	Guidi 2011		

Community farm

Community farm refers to a collaborative farming model typically found in urban areas, growing crops in mostly outdoor conditions to provide local food to the communities (Poulsen et al. 2017) (Fig. 1A). This type of farming model is prevalent in countries such as the United States, Australia, the United Kingdom, and also in Southeast Asia (Guitart et al. 2012). The common crops that urban farmers grow in community farms are mostly fruits and leafy vegetables including long beans, okra, eggplant, pumpkins, cucumbers, and spinach (Tay et al. 2024). This urban farming model emphasises collective efforts between urban farmers compared to traditional farming by supporting local agriculture and reducing the need for long-distance transportation (Giyarsih et al. 2024). There is an intensive influence on residents involved in community farms, as the impacts are not only coming from food production but it also strengthens community unity through outdoor physical activity. This also contributes to the restructuring of unused land, fostering community development, providing therapeutic and nutritional benefits, and enhancing the psychological well-being of residents (Yusoff et al. 2017). However, it also presents a set of challenges such as land access, environmental conditions, resource allocation, and community participation (Mauerhofer 2016; Salim et al. 2022).

Indoor farm

Indoor farms are the most recognised and effective urban farm model where plants are grown in controlled conditions of temperature, humidity, and light (Wong et al. 2020) (Fig. 1B). While community farming can vary in scale from small-scale operations to larger farms, indoor farming most-

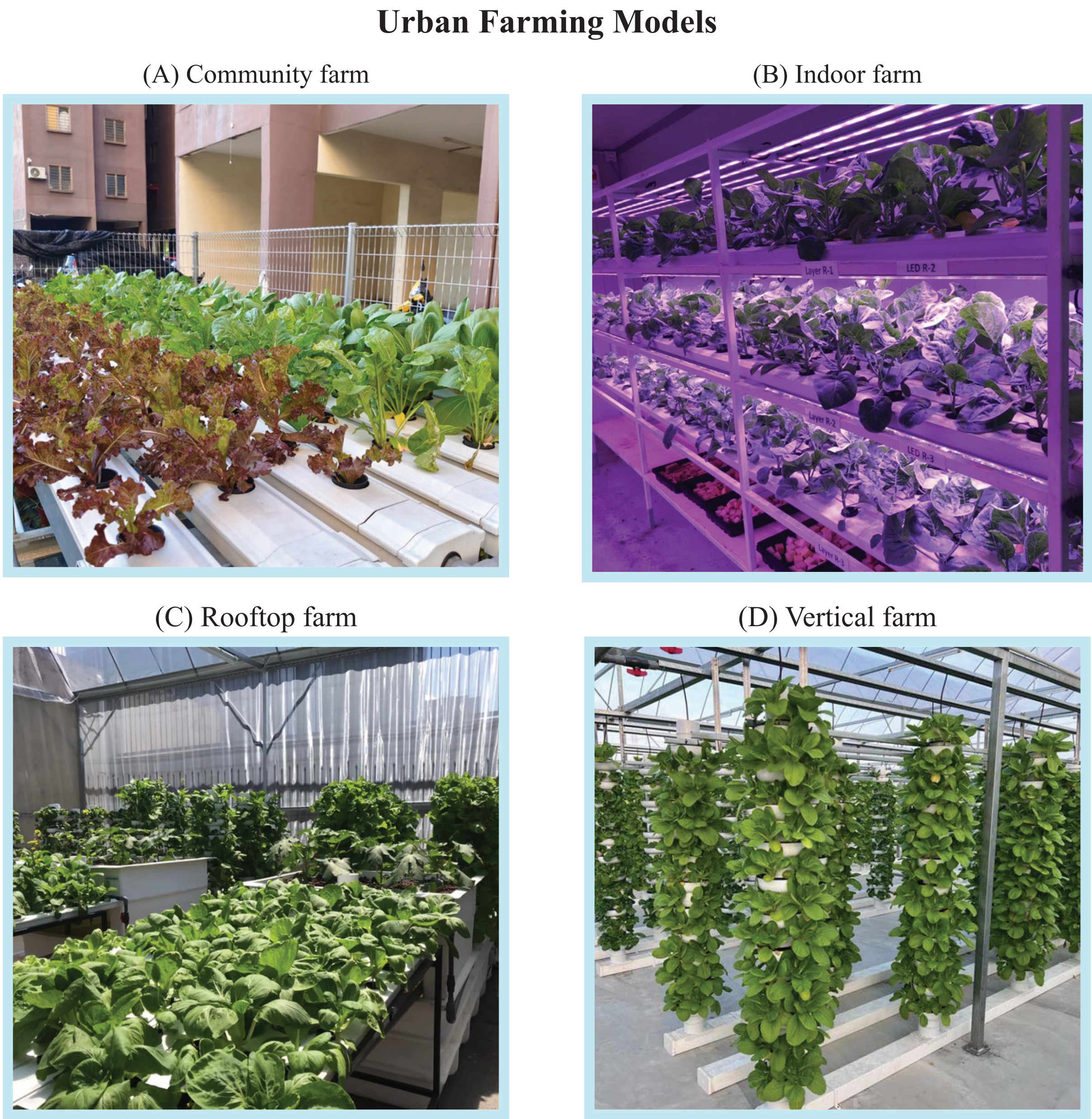

Figure 1. Urban farming models. **A.** Community farm; **B.** Indoor farm; **C.** Rooftop farm; **D.** Vertical farm.

ly involves small-scale vertical gardens to large commercial facilities (Benis and Ferrão 2018). In indoor farming, crops are often grown hydroponically or aeroponically in vertical systems. The common crops grown in indoor farms are leafy greens including broccoli, cabbage, lettuce, mustard, and high-value herbs due to their needs and high demand (Ampim et al. 2022). Unlike community outdoor farming, which is limited by weather conditions, indoor farming enables year-round production of crops regardless of the season. This model of farming often involves the integration of advanced technologies such as LED lighting, climate control systems, sensors, and automation, which has been proven effective in optimizing plant growth, resource efficiency, crop quality and reducing pest-related challenges (Engler and Krarti 2021). Indoor farming is commonly practiced in countries with four seasons and limited arable land, or high population density such as the United States, Japan, and the Netherlands to allow year-round vegetable production with less dependence on prevailing environmental conditions (Mitchell 2022). However, significant initial capital investment, specialised knowledge, and technical expertise, with technology and automation are needed to effectively manage and operate indoor farming facilities (Shamshiri et al. 2018; Hati and Singh 2021; Van Delden et al. 2021).

Rooftop farm

A rooftop farm is a type of farming model which grows plants on the rooftop of the building utilising unused or underutilised space in urban areas (Sabeh 2016) (Fig. 1C). This model of farming in cities increases local food production, without using the global land and it emerges as an effective solution for food security, as rooftops constitute one-fourth of all urban surfaces worldwide (Drottberger et al. 2023). This type of farming model allows the integration of agriculture into densely populated urban areas where land for traditional farming may be limited or unavailable by maximizing land use efficiency and reducing pressure on agricultural land in urban areas (Rondhi et al. 2018). Rooftop farm varies from small-scale residential buildings to large commercial installations on industrial or institutional buildings. The rooftop farms are common in countries that lack arable land such as the United States, Canada, Germany, and Singapore (Appolloni et al. 2021). Unlike indoor farming, rooftop farms are exposed to the outdoor environment. Where they may benefit from some protection provided by the building structure, rooftop farms are still subjected to challenges from climate and seasonal changes (Zareba 2021). However, certain design features such as irrigation systems, and wind barriers can reduce the effect of these environmental impacts (Caputo et al. 2017). Rooftop farm employs various growing techniques including soil-based gardening, hydroponics, and aquaponics (Buehler and Junge 2016; Appolloni et al. 2020). The common crops grown in rooftop farms are mostly leafy greens, such as lettuce, chard, or pak choi that can withstand direct sun exposure (Buehler and Junge 2016). The rooftop farms serve multiple purposes such as providing green space for building occupants, improving energy efficiency, and providing food for local consumption (Hui 2011). Rooftop farms offer environmental benefits such as efficient water management, improved air quality, and urban heat island mitigation (Drottberger et al. 2023). Similar to community farming, rooftop gardens can foster community engagement by providing opportunities for education, social interaction, and urban gardening (Tay et al. 2024). However, the challenges arise in rooftop farming as it relies heavily on the careful selection of plants in cultivation that can withstand fluctuating growing conditions of temperature, sunlight, wind, and precipitation (Zareba 2021).

Vertical farm

Vertical farm is another urban farming model that involves growing plants in vertically stacked layers within, controlled indoor environments such as warehouses and skyscrapers, and incorporates advanced farming techniques like aeroponics, hydroponics, and aquaponics to optimise resources and crop growth (Katoch et al. 2024) (Fig. 1D). Vertical farms range from small-scale operations in shipping containers or urban warehouses to large-scale commercial facilities with multiple floors or levels (Birkby 2016). While rooftop farms utilise unused space on building rooftops, vertical farms take advantage of vertical space, allowing for higher crop yields per square foot of land area, which makes vertical farming well-suited for urban environments where space is limited (Kalantari et al. 2018). Similar to indoor farming, indoor vertical farms enable year-round production of crops regardless of external weather conditions (Avgoustaki and Xydis 2020). The vertical farm also often involves the integration of advanced technologies such as LED, climate control systems, sensors, and automation (Bhuyan et al. 2023). These approaches also offer various potential advantages, including decreased water consumption, shorter cultivation periods, and reduced reliance on pesticides or herbicides (Pomoni et al. 2023). While vertical farms are primarily focused on efficient commercial crop production, some vertical farms may incorporate elements of community engagement and education (Petrovics and Giezen 2022). However, due to the complexity and incorporation of different farming techniques of this farming model, technical skills and standard operating procedures are the major challenges which are essential for success of this type of farming model (Katoch et al. 2024).

Initiative of urban farming

Farming in urban areas isn't a novel concept in developing countries. It emerged in the late 1970s, recognising the necessity for food production within urban spaces to tackle food security issues (Bailkey and Greenstein 2024). According to the United Nations Development Program, around 800 million urban residents were engaged in farming by the mid-1990s (Bryld 2003). The continual rise of urban farming can be attributed to the influx of migrants from rural to urban regions, which heightens population density and consequently leads to a scarcity of fresh produce, particularly fruits and vegetables (Marzuki and Jais 2020). Moreover, urban areas are susceptible to disruptions in food supply caused by natural disasters like droughts and floods, as well as by man-made crises such as conflicts and pandemics (Daher et al. 2021). The COVID-19 pandemic, in particular, shed light on the significance of urban farming. Drastic restrictions on mobility and logistics disrupted food supply chains in various urban areas, resulting in temporary food shortages and inciting panic buying among consumers (Amukwelele 2022). These crisis events underscored the importance of urban farming, prompting governments to recognise the necessity of ensuring resilient food systems for their citizens. The urban farming market has experienced rapid growth in recent years, with revenue increasing from USD 146.21 Billion in 2023 to USD 159.92 Billion in 2024 at a CAGR of 9.4% (Urban Farming Global Market Report 2024). It is projected that global urban farming market revenue will further increase by USD 261.1 Million by 2032, with a 2.7% CAGR from 2023 to 2032 (Urban Farming Market Size 2023). Presently, approximately 5,290 companies worldwide are associated with the production of urban farming systems, materials, and/or fresh produce, with a significant concentration in the United States, India, and Western Europe (AgriTech Startups & Scaleups 2024). Table 2 outlines the top 10 companies in the urban farming market, along with their cultivation techniques and main crops (Urban Farming Market Size

Table 2. The top 10 companies in the urban farming market worldwide.

Company Name	System	Main crops	Variety	Location	Website
AeroFarms	Hydroponics	Microgreen	Micro kale, micro super mix's red cabbage, micro broccoli, micro arugula, red bok choy microgreens, micro wasabi, and micro rainbow mix's red cabbage microgreen.	United States	https://www.aerofarms.com/
Bowery Farming	Hydroponics	Leafy vegetables	Baby butter lettuce, baby romaine lettuce, crispy leaf lettuce, mixed greens, spring mix, baby kale, spinach, bok choy, and mustard frills.	United States	https://bowery.cp
		Herbs	Basil, cilantro, and parsley.		
		Berries	Strawberries		
BrightFarms	Hydroponics	Leafy vegetables	Crisp lettuce, red baby lettuce, baby romaine lettuce, arugula, mustard, Cressida, leaf lettuce, bak choy, oakleaf,	United States	https://www.brightfarms.com/
		Herbs	Basil, and mizuna.		
Gotham Greens	Hydroponics	Leafy vegetables	Salad, baby butterhead, butterhead, crispy green leaf, green oak leaf, romaine, arugula,	United States	https://www.gothamgreens.com/
		Herbs	Basil		
Farm.One	Hydroponics	Leaf greens	Spritzer lettuce, iceplant, and lettuce.	United States	https://farm.one/
		Microgreen	Spritzer lettuce, iceplant, micro sunflower shoot, micro red Russian kale, micro red cabbage, micro red amaranth, micro purslane, micro pac choy, micro okra, micro kohlrabi, micro Chinese cabbage, micro cabbage, and micro buckwheat.		
		Herbs	Akatade, anise hyssop, arugula, saltwort, and moringa leaves,		
		Edible flowers	Red blotch, chervil, kosaitai flowering brassica, bachelor button, and assorted viola flowers.		
Freight Farms.	Hydroponics	No fresh produce.	-	United States	https://www.freightfarms.com/
Infarm	Hydroponics	Vegetables	Green crisphead, caravel, red oak leaf, green romaine, butter lettuce, red leaf, green leaf, crystal lettuce, cauliflower, kohlrabi, and radishes.	United States	https://www.infarm.com/
		Microgreen	Basil microgreen, and arugula.		
		Herbs	Sage, Thai basil, coriander, thyme, dill, green basil, mountain coriander, green cress, and Bordeaux basil.		
		Fruiting	Strawberries, and tomatoes.		
LocalGarden	Hydroponics	Vegetables	Broccoli, red cabbage, lettuce,	United States	https://localgarden.co.in/
		Fruit	Capsicum, sweet corn,		
		Herbs	Mint,		
Plenty	Hydroponics	Leafy vegetables	Baby red lettuce, baby leaf lettuce, baby romaine, baby arugula, baby red romaine, baby mustard greens, baby spinach, baby kale, baby mustard greens, baby spinach, baby kale,	United States	https://www.plenty.ag/
Square Roots	Hydroponics	No fresh produce.	-	United States	https://www.squarerootsgrow.com/

2023). This concentration can largely be attributed to supportive policies for urban farming in these countries. In the United States, the Urban Agriculture Act (Urban Agriculture Act 2016) provides support through grants, technical assistance, and research funding, while the Local Food, Farms, and Jobs Act of 2013 (Local Food, Farms, and Jobs Act 2013) funds programs that increase access to fresh, locally produced food in urban areas. Many United States cities also offer support for community gardens and urban farming initiatives through land leases, grants, and technical assistance (Halvey et al. 2021). Similarly in India, policies such as the National Urban Livelihoods Mission (NULM 2014) and the National Policy for Farmers (National Policy for Farmers 2007) prioritise urban and peri-urban agriculture to enhance food security and livelihoods. Additionally, initiatives like the Smart Cities Mission (SCM 2015) integrate urban agriculture into development plans to foster sustainable urban environments (Singh and Mishra 2023). In European countries, policies and initiatives varies, reflecting diverse approaches to agriculture and urban development (Curry et al. 2015). The European Union Common Agricultural Policy, primarily focused on rural agriculture, also supports urban farming by promoting local food systems and sustainable agriculture (Cvijanovic et al. 2018). Moreover, many cities in Western Europe have implemented policies to facilitate urban agriculture, including land access, funding for community gardens, and incentives for rooftop and vertical farms (Sanyé-Mengual et al. 2016). Governments and organizations in Western Europe are also investing in research and innovation in urban agriculture to develop sustainable practices and technologies for urban food production (Lohrberg et al. 2016).

Challenges of urban farming and strategies to improve

Access to land and irrigation

Access to land for urban farming is a significant barrier, especially in densely populated areas (Zhu et al. 2024). These challenges can be improved by partnering with local government to identify and lease a vacant lot for urban agriculture, establishing community land, and promoting urban agriculture zoning policies that support farming activities (Meenar et al. 2017). Other than that, irrigation management is very important for urban farming, especially in water-stress regions (Tixier and De Bon 2006). Integration of techniques such as drip irrigation, rainwater harvesting, grey water recycling, and technological innovations such as Smart Irrigation Systems, Cloud-based Monitoring and Control Systems, and desalination technologies for the use of seawater or brackish water can be employed to optimize water usage and minimize water waste in urban farming (Mason et al. 2019).

Pest and disease management

Urban farming faces a range of challenges, particularly concerning pests and diseases. This issue is compounded by the close proximity of crops to each other and human habitation, leading to significant yield losses (Specht et al. 2014). However, through interdisciplinary research collaborations and active industry engagement, the long-term viability of urban farming can be sustained. In outdoor urban farming, such as aquaponics and hydroponics, pest challenges similar to those arise in traditional farming. Water-borne diseases, in particular, can spread rapidly, potentially destroying entire yields (Sharma et al. 2018). Studies have highlighted microbial pathogens in aquaponic (Dinev et al. 2023; Teoh et al. 2023) and hydroponic farming (Osdaghi 2023). Conversely, indoor setups have the advantage of employing advanced technologies like water filter systems such as membrane filtration and the treatment with ozone and/or UV radiation in aquaponics to effectively mitigate microbial threats (Giaquinto et al. 2022; Topalcengiz et al. 2023). Additionally, implementing proper quarantine facilities can further enhance pest management in indoor farming environments (Rajeshwari et al. 2024).

Conventional chemical pesticides are often unsuitable for use in soilless cultivation systems due to the risk of contaminating water supplies and harming beneficial organisms essential for the functioning of aquaponics and hydroponics, such as fish or beneficial microbes (Folorunso et al. 2021). To mitigate yield losses in urban farming caused by pests and diseases, integrating AI-driven technologies for precise pest detection and control, along with adopting integrated pest management practices like crop rotation, companion planting, and biological control methods, become imperative (Gossen and McDonald 2020; Chojnacka 2024). These approaches can effectively manage pests and diseases while minimizing reliance on chemical pesticides. Hence, urban farmers must embrace alternative pest management strategies tailored to the specific conditions of soilless cultivation systems.

Financial constraints

Financial limitations are one of the obstacles to the success and expansion of urban farming projects. Setting up and maintaining urban farming systems demand significant initial investments in infrastructure, equipment, and necessary supplies like irrigation systems (Weidner et al. 2019). Additionally, the operational costs, including land leasing or purchasing fees, utilities, and labor expenses, can further strain on limited financial resources (Carolan 2020b). Based on data from the Food & Fertiliser Technology Center, a warehouse plant factory requires a minimum building size of 2,400 square feet. This type of facility can plant up to 22,000 seedlings, with an estimated initial investment of USD 166,666.70 (FFTC

2022). This cost includes the infrastructure construction, lighting systems installation, operational control, and monitoring systems setup, and procurement of operating equipment. For aspiring urban farmers, accessing capital for startup costs and ongoing operations can be particularly challenging, especially in low-income communities where access to credit and investment opportunities is limited. Moreover, the uncertain economic returns and market volatility associated with urban agriculture may deter potential investors and lenders, exacerbating financial barriers (Adisa et al. 2024). Addressing these financial constraints necessitates innovative financing mechanisms, such as microloans, grants, crowdfunding, public-private partnerships, the establishment of a supply chain, adoption of advanced technology to reduce manual labor and costs (Das Nair and Landani 2020; Issahaku et al. 2020). Furthermore, policies that incentivise investment in urban agriculture, such as tax breaks, subsidies, and technical assistance programs, can help alleviate financial burdens and promote the economic viability of urban farming as a sustainable and inclusive livelihood option for urban residents (Ward et al. 2016; Ahmed and Sallam 2020).

Knowledge and skill gaps

One of the significant challenges facing urban farming initiatives is the presence of knowledge and skill gaps among farmers, residents, and stakeholders involved in agricultural activities (Sanyé-Mengual et al. 2016). The complexity of the systems exacerbates these challenges, necessitating the development of standard operating procedures and the provision of knowledge in the maintenance of the systems. Thus, to effectively operate and maintain urban farming systems, proficiency in both fundamental and advanced knowledge is essential to ensure consistent food production outcomes (De Wit 2014). In addition, expertise in managing unforeseen issues such as fluctuations in water quality, malfunction of systems or equipment, nutrient deficiencies or imbalances, pest and disease outbreaks, and algal blooms are essential (Yanes et al. 2020). In this case, training and capacity-building programs to empower individuals with the requisite skills and knowledge to engage effectively in urban farming are compulsory (Maponya et al. 2016). Moreover, addressing knowledge gaps extend beyond technical aspects, it also encompasses understanding of the market dynamics, business management, and regulatory compliance related to urban agriculture (Guidi 2011). Addressing these knowledge and skill gaps requires targeted educational interventions, vocational training programs, and extension services tailored specifically for urban farmers and community members. These efforts empower individuals to overcome barriers and maximize the potential of urban farming for food security, livelihoods, and community empowerment (Tay et al. 2024).

Challenges arising from limited networking between universities, government, and industries

The lack of networking between universities, government, and industries leads to knowledge isolation. Each sector if operated independently, leads to limited sharing of research findings, best practices, and innovation (Weidner et al. 2019; Carolan 2020a). This fragmentation hampers the development of comprehensive solutions to challenges in urban farming. Other than that, without effective networking, universities, government, and industry stakeholders may duplicate efforts, which wastes resources and diminishes the impact of the initiative in aiming, and addressing challenges in urban farming (Xi et al. 2022). Addressing these challenges requests, building strong networks and partnerships between universities, government, and industry stakeholders can benefit from interdisciplinary approaches, innovative solutions, and holistic strategies, maximizing its potential to address food security, environmental sustainability, and economic development in urban areas (Soini et al. 2018). This approach will create an enabling environment that encourages innovation, entrepreneurship, and community engagement in urban farming practices, ultimately contributing to broader socio-economic and environmental objectives (Malan 2015; Provė et al. 2018).

Conclusion

Urban farming holds immense potential as a sustainable solution to address food insecurity, promote economic development, and enhance community resilience in cities. While it offers numerous benefits, such as increased access to fresh produce and environmental sustainability, urban farming also faces challenges related to land and irrigation access, pest and disease management, financial constraints, knowledge and skill gaps, and limited networking between universities, government, and industries. Insights from this study highlight the need for comprehensive strategies to enhance urban farming's sustainability and productivity, emphasizing its critical role in urban food security, sustainable development, and resilience. This review underscores the importance of a multifaceted approach, including innovative financing solutions, supportive policies, advanced technological integration, targeted training programs, and stronger stakeholder networks to further enhance the sustainability and productivity of urban farming.

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