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Local Food Distribution System Based on Urban Farming: A Literature Review

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ABSTRACT

Urban farming is an innovative approach to utilize limited urban space for efficient and sustainable food production. It has the potential to shorten supply chains, improve food security, and provide numerous socio-economic and environmental benefits. However, its implementation faces significant challenges. This literature review aims to: (1) analyze the contribution of urban farming to food security and supply; (2) identify the application and impact of technology on productivity; (3) assess its aesthetic value for communities; and (4) map the opportunities and challenges of urban farming-based local food distribution systems. A narrative literature review was conducted following PRISMA guidelines. Four electronic databases (Scopus, LENS, Dimensions, ProQuest) were searched for relevant articles published up to November 2024. Studies were screened based on predefined inclusion and exclusion criteria. The search identified an initial 249 articles, from which 55 studies were selected for inclusion after screening. The synthesis of these studies shows that urban farming significantly enhances local food availability, supports household economies, and strengthens community resilience, with numerous examples from Indonesia and globally. Key technologies like hydroponics, aquaponics, and vertical farming are shown to dramatically increase productivity in limited spaces. Furthermore, urban farming adds significant aesthetic, social, and ecological value to urban environments. Key challenges identified include infrastructural limits, unsupportive policies, and low public awareness. Urban farming is a strategic solution to improve food sustainability and community welfare in cities. To overcome existing challenges and maximize its potential, a collaborative approach involving policy support, technological innovation, and public education is essential.

1. INTRODUCTION

Urban agriculture is a strategy for utilizing narrow land in urban areas to produce fresh food, shorten the distribution process, and increase household economic access [1]. It includes the activities of cultivating, processing, and distributing food in and around urban areas by utilizing available space [2]. Urban farming is a key means to increase urban food security [3], contributing to environmental, social, and economic health through a sustainable approach [4]. It also promotes local economic development [5], with models like aquaponics and fast-harvest microgreens adding significant monetary value [1, 6]. Technologies such as vertical farming and green roofs maximize production in limited spaces, providing both environmental and aesthetic benefits while empowering communities to produce their own food [4, 7, 8].

Urban agriculture offers a strategic solution to the challenges of urbanization by providing significant contributions to food security, economic opportunity, and ecological and social well-being [9-12]. However, its adoption is hindered by various challenges.

Based on this background, this review was conducted on published scientific literature to analyze the urban farming-based local food distribution system. The specific objectives of this study are to synthesize evidence on: (1) How urban farming contributes to urban food security and its impact on food supply; (2) How technology is applied in urban farming and its impact on agricultural productivity; (3) How urban farming provides aesthetic value for urban communities; and (4) What are the opportunities and challenges of a local food distribution system based on urban farming. Despite the growing body of literature on urban agriculture, few reviews have systematically synthesized its role in local food distribution systems, particularly within Southeast Asian contexts. To address this gap, the following section outlines a

structured narrative review conducted to explore the contributions, technologies, aesthetic values, and challenges of urban farming in enhancing food system resilience.

2. METHODS

This study was conducted as a Narrative Literature Review (NLR), following the methodological framework of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement to ensure a systematic and transparent process.

2.1 Search strategy

A systematic search was conducted across four electronic databases: Scopus, LENS, Dimensions, and ProQuest. The searches were performed between October 24, 2024, and November 25, 2024. To ensure a comprehensive search, a detailed Boolean query string was developed and adapted for each database, combining keywords related to urban agriculture and local food distribution. The full query strings used for each database are detailed in Table 1.

2.2 Inclusion and exclusion criteria

Studies were selected based on the following criteria:

- Inclusion criteria:
  - Peer-reviewed journal articles, conference papers, or reviews.
  - Studies focusing on urban farming, urban agriculture, or related concepts.
  - Studies discussing local food distribution, supply chains, or food security in an urban context.
  - Published in English or Indonesian language.
- Exclusion criteria:
  - Studies not available in full text.
  - Editorials, commentaries, and book reviews.
  - Studies where urban farming was not the primary focus.

Table 1. A literature search was conducted through several databases with query strings

Indexer	Query string	Results	Search Date
Scopus	""urban farm" OR "urban farmer" OR "urban farmers" OR "urban farming" OR "urban farms" OR "city farm" OR "city farmers" OR "city farms" OR "urban horticulture*" OR "urban agriculture " OR "sustainable agriculture" OR "metropolitan agriculture*" OR "inner city farm*" OR "urban gardening" OR "rooftop farm*" OR "urban food access*" AND "local food distribution*" OR "local food supply chain *" OR "local food network*" OR "regional produce distribution system*" OR "local food circulation system*" OR "short chain food distribution*" OR "local food logistics*" AND Indonesia	**42**	November 25, 2024
Lens	"urban farm*" OR "city farm*" OR "urban horticulture*" OR "urban agriculture*" OR "sustainable agriculture*" OR "metropolitan agriculture*" OR "inner city farm*" OR "urban gardening*" OR" rooftop farm*" OR "urban food access*" AND "local food distribution*" OR "local food supply chain*" OR "local food network*" OR "regional produce distribution system*" OR "local food circulation system*" OR "short chain food distribution*" OR "local food logistics*"	**35**	October 24, 2024
Dimension	agriculture AND (urban AND (food AND distribution	**25**	October 24, 2024
ProQuest IOP Conference Series. Earth and Environmental Science	"urban farm*" OR "city farm*" OR "urban horticulture*" OR "urban agriculture*" OR "sustainable agriculture*" OR "metropolitan agriculture*" OR "inner city farm*" OR "urban gardening*" OR" rooftop farm*" OR "urban food access*" AND "local food distribution*" OR "local food supply chain*" OR "local food network*" OR "regional produce distribution system*" OR "local food circulation system*" OR "short chain food distribution*" OR "local food logistics*"	**49**	October 24, 2024
Pro Quest Sustainability	("urban farm" OR "urban farmer" OR "urban farmers" OR "urban farming" OR "urban farms") OR ("city farm" OR "city farmers" OR "city farms") OR "urban horticulture*" OR ("urban agriculture") OR "metropolitan agriculture*" OR "inner city farm*" OR ("urban gardening") OR "rooftop farm*" OR "urban food access*" AND "local food distribution*" OR "local food supply chain*" OR "local food network*" OR "regional produce distribution system*" OR "local food circulation system*" AND Indonesia	**55**	October 24, 2024
	("urban farm" OR "urban farmer" OR "urban farmers" OR "urban farming" OR "urban farms") OR ("city farm" OR "city farmers" OR "city farms") OR "urban horticulture*" OR ("urban agriculture") OR "metropolitan agriculture*" OR "inner city farm*" OR ("urban gardening") OR "rooftop farm*" OR "urban food access*" AND "local food distribution*" OR "local food supply chain*" OR "local food network*" OR "regional produce distribution system*" OR "local food circulation system*" AND Indonesia	**43**	October 24, 2024

2.3 Study selection

All records identified through the database search were imported into the Covidence software for duplicate removal and screening. Two reviewers independently screened titles and abstracts against the inclusion criteria. Any disagreements were resolved through discussion. The full texts of potentially eligible articles were then retrieved and assessed for final inclusion. The detailed process is illustrated in the PRISMA flow diagram (Figure 1).

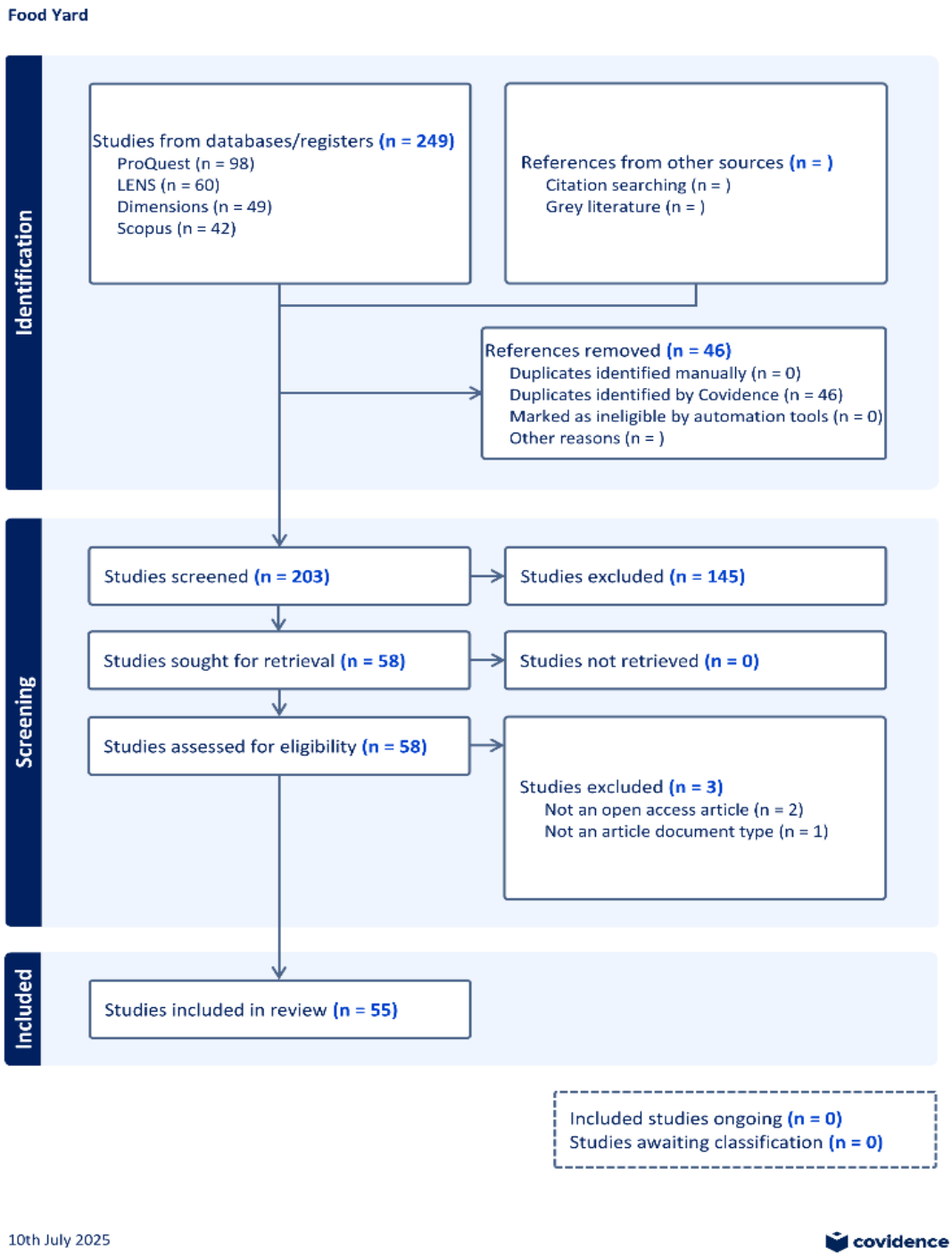

Figure 1. PRISMA diagram (Preferred reporting item for systematic review and meta-analysis)

2.4 Quality appraisal

A critical appraisal of the included studies was conducted to assess their methodological quality and risk of bias. The Critical Appraisal Skills Programme (CASP) checklist for Qualitative Studies was adapted for this purpose, as the majority of included studies utilized qualitative or descriptive designs. The checklist focuses on the clarity of research aims, appropriateness of methodology, and validity of findings. This step helps in understanding the strength of the evidence synthesized in this review.

3. RESULT

3.1 Quality appraisal and study characteristics

Of the 55 included studies, the quality appraisal using CASP checklist indicated that 35 studies were of high quality (demonstrating clear objectives, rigorous methodology, and valid findings), 15 were of moderate quality (lacked detail in certain methodological aspects), and 5 were of low quality. While low-quality studies were not excluded, their findings were interpreted with caution.

Table 2. Characteristics of the representative included studies

Appraisal Item	Description /Result
Total Included Studies	55 studies
Quality Appraisal Tool	CASP (Critical Appraisal Skill Programme) Checklist
Quality Appraisal Results	a) High quality: 35 studies b) Moderate quality: 15 studies c) Low quality: 5 studies
Dominant Geographic Focus	Various countries, with a significant focus on Indonesia (15 studies)
General Methodology	Predominantly qualitative, including case studies, descriptive analyses, and program reports
Characteristics of Representative Studies	

Note: Author contributions

The included studies originated from various countries, with a significant portion (n = 15) focusing on Indonesia. Methodologies were predominantly qualitative, including case studies, descriptive analyses, and community program reports. A summary of representative studies is provided in Table 2.

3.2 Thematic synthesis

The findings from the 55 studies were synthesized into four key themes corresponding to the research objectives (Table 3).

Table 3. Key themes corresponding to research objectives

Ref.	Country	Study Design	Key Finding Related to Urban Farming
[13]	Indonesia (Banda Aceh)	Case Study	Hydroponics improves production quality and farmer competence on limited land; UF supported communities during the COVID-19 pandemic.
[4]	Indonesia (Semarang)	Descriptive Study	Green roofs can yield up to 5.94 kg/m²/year, enhancing food security for low-income households.
[14]	Indonesia (Blitar)	Program Report	Aquaponics and microgreens provide productive and economical solutions for land limitations, strengthening the local economy.
[15]	USA (Chicago)	Case Study / Activism Report	Urban farming empowers communities, provides fresh food access in "food deserts," and strengthens food sovereignty.
[16]	Brazil (Rio de Janeiro)	Case Study	Strengthens local producer-consumer relationships, promotes the local economy, and provides fresh food access.

Theme 1: Contribution to urban food security and supply

Urban farming is consistently identified as a vital strategy for improving food security in cities. It enhances the local food supply by increasing the availability of fresh produce, thereby reducing dependence on external and often fragile supply chains. Studies from Indonesian cities like Makassar, Ternate, and Banyumas highlight how utilizing vacant land provides direct access to food and helps communities cope with disruptions like the COVID-19 pandemic. Economically, it offers income opportunities and supports household stability.

Theme 2: Application of technology and impact on productivity

Modern technologies are crucial for maximizing the efficiency of urban farming. Hydroponics, aquaponics, vertical farming, and green roofs are repeatedly cited as effective solutions for overcoming space limitations. Hydroponics in Banda Aceh maximized land use and improved production quality. Aquaponics and microgreens in Blitar provided productive and economical solutions. Vertical farming increases yields in small spaces, and green roofs in Semarang were shown to yield significant produce annually while providing environmental benefits. These technologies enable year-round production and optimize resource use.

Theme 3: Aesthetic and social value for urban communities

Beyond food production, urban farming provides significant aesthetic value by converting underutilized or barren land into green, productive spaces. This beautifies the urban landscape, improves air quality, and reduces the urban heat island effect. Socially, community gardens and urban farms act as hubs for social interaction, strengthening community cohesion and identity. They also serve as educational spaces, raising awareness about sustainability and healthy eating habits.

Theme 4: Opportunities and challenges

The primary opportunities lie in enhancing food security, strengthening local economies through entrepreneurship, and improving environmental sustainability. However, significant challenges persist. These include limited infrastructure and resources, unsupportive or complex bureaucratic policies, difficulties in accessing markets and competing with large-scale supply chains, and a lack of public awareness or participation.

4. DISCUSSION

4.1 Contribution to urban food security and supply

Urban farming is a strategic approach to enhance food security by utilizing narrow urban land for food production [1, 4]. It increases the availability of fresh produce, reduces dependence on external food sources, and improves local food quality and diversity. Practices such as aquaponics, microgreens, and polybag cultivation enable efficient food production in dense areas [1, 17].

Urban farming supports household income and economic stability, while also creating jobs and encouraging entrepreneurship [18]. It serves as an educational tool that raises awareness about sustainable agriculture and healthy eating habits [13] and fosters social cohesion through community involvement and cooperation [18].

Local food production minimizes food miles, transportation expenses, and emissions from a supply chain standpoint [1]. It minimizes spoilage risk and enhances freshness and nutritional value [13, 18].

In Indonesia, urban farming initiatives in Banda Aceh [13], Jakarta [19], Banyumas [7], Blitar [1], Semarang [20], Makassar [9], Ternate [10], Sukabumi [17], Bogor [8], and

Bandung [18] demonstrate its role in strengthening food self-sufficiency, especially during the COVID-19 pandemic. Programs like KRPL (*Kawasan Rumah Pangan Lestari*) or Sustainable Food House Area [21] and thematic villages [21] support local food consumption and education.

Globally, urban farming improves food access and affordability in cities like Kuala Lumpur [11], Amsterdam [12], Paris [22], Philadelphia [23], Chicago [15], Rio de Janeiro [16], Niamey [24], and Kampala [25]. It promotes local food sovereignty [16], strengthens producer-consumer relationships [16, 26], and supports vulnerable communities [23].

4.2 Application of technology and impact on productivity

Urban agriculture integrates agricultural activities with urban setting to enhance food security, sustainability, and socio-economic well-being [1]. Innovative technologies such as hydroponic (nutrient-based cultivation), aquaponics (integration of hydroponics and aquaculture), and microgreens (fast-cycle vegetables) offer efficient solutions for limited urban space. In comparison to traditional techniques, these strategies improve water and nutrient use, reduce waste, and increase productivity [1].

Green roof technology transforms rooftops into productive space, contributing to food availability, reducing urban food insecurity, improving air quality, and mitigating urban heat [4]. In Semarang, green roofs yield up to 5,94 kg/m^2/year, demonstrating their potential to reduce food insecurity [27].

Technological innovation and community empowerment are widely recognized as critical drivers of future urban food security. Advanced cultivation systems such as vertical farming and hydroponics have demonstrated the capacity to generate high yields within spatially constrained environments [28]. In Blitar, the integration of aquaponics and microgreens has effectively addressed land limitations and enhanced local food production [1], while hydroponic practices in Banda Aceh have improved land use efficiency, product quality, and farmer competence [13]. Consumer satisfaction with hydroponic produce in Padang further underscores its market viability [29], and wall gardening has been shown to support sustainable urban food chains [30].

Emerging technologies—including drip irrigation, organoponics, and machine learning for plant detection—have significantly improved the productivity and operational efficiency of urban farming systems [31, 32]. In Ghana, urban farming innovations have contributed to poverty alleviation through street food entrepreneurship [24], whereas precision agriculture has enhanced biodiversity and offered adaptive responses to climate change [33].

Localized innovations such as polybag cultivation of porang in Sukabumi [17], fish farming in buckets in Bogor [8], and vertical culture systems in Bandung [34] exemplify scalable models for urban agricultural productivity. The application of arbuscular mycorrhizal fungi (AMF) as biofertilizers has also been shown to increase plant resilience under abiotic stress conditions [35].

Agroecological strategies in Cuzco, Peru, which combine hydroponics, aquaponics, and composting, have improved soil fertility and promoted socio-economic sustainability [36]. Controlled-environment systems such as the Urban Mini Plant Factory (UMPF) offer promising solutions for high-yield cultivation in limited urban spaces [14]. In Indonesia, structured programs such as KRPL in Semarang [20], cluster-based farming in Banyumas [7], and mixed farming in Ternate [10] have begun integrating urban farming technologies to enhance food production efficiency and resilience, illustrating the transformative potential of technology-driven community models.

4.3 Aesthetic and social value for urban communities

Urban farming contributes holistically to the aesthetic, ecological, psychological, educational, and social dimensions of urban life. By transforming underutilized spaces into green and productive areas, it enhances visual appeal, improves air quality, and reduces urban heat, particularly through green roofs and rooftop gardens in cities like Semarang and Jakarta [4, 19, 34, 37]. These green interventions not only beautify the built environment but also support diverse plant species and ecological habitats, enriching urban biodiversity and sustaining micro-ecosystems, as seen in community gardens across France and Indonesia [22, 23, 36].

Socially, urban farming fosters interaction and strengthens community identity by creating shared spaces that encourage collaboration, pride, and cohesion [15, 18, 36, 37]. In Jakarta and Chicago, gardening activities have been linked to increased neighborhood safety and a stronger sense of ownership [19, 23]. Psychologically, green spaces offer relaxation and emotional well-being, reducing stress and promoting mental health, with Bandung serving as a notable example of urban gardens contributing to public resilience [18, 23, 31, 38].

Urban farming also serves as an educational platform, promoting ecological awareness and sustainable practices across generations [2, 5, 38]. Techniques such as aquaponics and *Budikdamber* (fish farming in buckets) provide hands-on learning experiences that engage communities in food production and environmental stewardship [5, 8]. Artistic and cultural expression is embedded in urban farming through the integration of murals, sculptures, and garden designs that blend nature with creativity, enriching the urban landscape and reinforcing cultural identity [15, 30, 36].

Furthermore, urban farming enhances urban livability by activating vacant land into inclusive green spaces, offering aesthetic solutions to ecological challenges in densely populated areas, especially in developing countries [4, 19, 23, 31, 37]. Its multifunctional role makes it a strategic approach to improving quality of life, fostering biodiversity, and strengthening social cohesion in modern cities.

4.4 Opportunities and challenges

While urban farming offers substantial aesthetic, ecological, and social advantages to urban communities, its implementation is not without challenges. The diverse practices and technologies discussed across regions reveal both the possibilities and constraints of integrating urban agriculture into local food systems. To fully realize its transformative impact—whether in enhancing food security, promoting sustainability, or enriching urban life-urban farming must navigate a complex landscape of infrastructural constraints, policy gaps, and community engagement barriers. These dynamics form the basis of the final theme, which explores the key opportunities and challenges in developing resilient, inclusive, and technology-driven local food distribution system.

Urban farming presents substantial opportunities for strengthening local food distribution systems in urban areas. By providing fresh produce directly to communities, it enhances food security, reduces dependence on external supply chains, and supports nutritional diversity [12, 13, 16, 39]. The involvement of youth in urban agriculture fosters entrepreneurship and innovation [18], while the utilization of limited urban space contributes to biodiversity and sustainable land use [40]. Economically, urban farming reduces household food expenses, creates job opportunities, and strengthens local economies through direct producer-consumer relationships [5, 18, 30, 34]. Environmentally, it mitigates urban heat and air pollution, improves ecological awareness, and promotes sustainable land management [23, 28, 39].

However, these opportunities are tempered by persistent challenges. Limited infrastructure, especially in densely populated areas, constrains the scalability of urban farming initiatives [1, 5, 34]. Regulatory and bureaucratic barriers hinder integration into formal urban planning, while inconsistent product quality and low farmer competence in marketing affect economic viability [13, 28, 31, 40]. Market competition with established supply chains, price instability, and limited consumer outreach further restricts distribution effectiveness [18, 13, 30]. Social and cultural factors—such as low public awareness and unequal access among low-income communities—also impede widespread adoption [3, 12, 41, 42].

Addressing these challenges requires coordinated, cross-sectoral collaboration among government, private sector, academia, and communities. Such synergy is essential to overcome infrastructural and policy limitations while maximizing the benefits of urban farming for food security, environmental sustainability, and economic resilience. Ultimately, the success of urban farming-based local food distribution systems depends on proactive policy support, technological innovation, and inclusive community education [4, 39].

4.5 Limitations and future research

While this review provides a comprehensive synthesis of urban farming's role in local food distribution systems, several limitations must be acknowledged. First, the narrative literature review approach, although suitable for thematic exploration, lacks the statistical rigor of a full systematic review or meta-analysis. As such, the findings are based on qualitative synthesis rather than quantitative effect sizes, which may limit generalizability.

Second, the inclusion criteria restricted the review to studies published in English and Indonesian, potentially excluding relevant literature in other languages and introducing language bias. Third, although a critical appraisal was conducted using the CASP checklist, the review did not apply a formal scoring system to weight the quality of evidence, which could have provided a more nuanced interpretation of findings.

These limitations highlight several avenues for future research. Quantitative studies are needed to assess the cost-effectiveness and long-term impacts of specific urban farming technologies on food security, environmental outcomes, and community well-being. Longitudinal research could provide insights into the sustainability and scalability of urban farming initiatives over time. Additionally, comparative policy analyses across different urban contexts would help identify regulatory frameworks and governance models that best support the integration of urban agriculture into formal food systems. Finally, future reviews may benefit from incorporating grey literature and multilingual sources to capture a broader spectrum of practices and innovations.

5. CONCLUSIONS

The local food distribution system based on urban farming offers a vital solution to urban food security challenges. It shortens supply chains, reduces carbon emissions, and provides critical economic, social, and ecological benefits. The integration of modern technology can overcome spatial limitations and optimize production. However, realizing its full potential requires overcoming significant challenges related to infrastructure, policy, and public awareness. A concerted, cross-sectoral effort involving proactive policy support, technological innovation, and community education is necessary to establish urban farming as an integral strategy for creating resilient and sustainable cities.

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