

Integrating Urban Agriculture into Residential Building Designs to Address Urban Food Deserts: A Sustainable Solution for Food Security

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Abstract: Imagine a future where residential buildings not only shelter citizens but also nourish them. This presentation unveils the potential of integrating urban agriculture into residential designs to combat food deserts, enhance food security, and foster sustainable communities.

Through a cutting-edge mixed-methods approach, this study explores the symbiotic relationship between building design, urban agriculture, and community engagement. By analyzing case studies, conducting expert interviews, and surveying residents, we uncover the keys to successful integration.

Our findings reveal a transformative model for urban food systems, where residential buildings become hubs for sustainable food production, community building, and environmental stewardship. Join us in revolutionizing the urban food landscape and redefining the future of edible architecture and food security for future generations.

Keywords: Urban Agriculture, Food Security, Sustainable Communities, Edible Architecture, Urban Food Systems

1. Introduction

As the global population approaches a 70% urbanization milestone by 2050, cities are increasingly becoming concrete jungles, grappling with issues like thermal discomfort, climate change, and food insecurity. However, envisioning a future where buildings blend functionality with sustainability and architecture harmonizes with nature can redefine urban landscapes. In Africa, where urbanization is accelerating rapidly, it is essential to rethink our approach to architectural sustainability by adopting a holistic framework that harmonizes social, economic, and environmental aspects. Inspired by rural communities known for their longevity and health, we can transform buildings into verdant food hubs that integrate food production, waste mitigation, and community engagement into residential designs.

This approach addresses food insecurity, mitigates health challenges, and fosters social interaction while unlocking benefits like increased access to fresh produce, reduced carbon footprints, and vibrant green spaces. To fully realize urban agriculture's potential, we must explore design principles, technological innovations, and policy interventions that support its integration into residential buildings. By doing so, we can create sustainable, resilient, and

food-secure cities that prioritize citizens' and environmental well-being, aligning with the UN's Sustainable Development Goals.

1.1 Literature Review

Food scarcity in urban areas has led to the emergence of food deserts, characterized by limited healthy food options. This issue arises from economic disparities, inadequate infrastructure, and shifting dietary patterns, resulting in detrimental health outcomes, including obesity, diabetes, and chronic diseases. Studies also link food deserts to psychological distress and hindered child development, imposing substantial economic burdens on healthcare systems.

Innovative solutions, like integrating agriculture into residential buildings through vertical planting, empower communities to reclaim their food supply. Vertical farming increases crop yields and reduces transportation emissions, providing fresh produce to underserved areas. This approach offers a viable solution to address food scarcity and promote sustainable urban agriculture.

1.2 The Potential of Residential Agriculture

Integrating urban agriculture into residential design can significantly impact public health and well-being. By enhancing access to fresh produce and improving indoor air quality, urban agriculture supports sustainable living practices and fosters community connections. As the global population urbanizes, residential agriculture can help ensure food security and enhance sustainability across diverse cities.

1.3 Design Principles for Successful Integration of Urban Agriculture

A comprehensive approach is necessary for integrating urban agriculture into design frameworks. Key principles include spatial optimization, water resource management, energy efficiency, soil fertility enhancement, and climate resilience. Global cooperation is essential to promote these principles and ensure a sustainable future.

1.4 Technological Innovations in Urban Agriculture

Urban agriculture is being transformed by high-tech innovations like hydroponics and aeroponics, which optimize space and reduce water consumption. The Internet of Things (IoT) allows for real-time monitoring of growing conditions, enhancing efficiency. New materials, such as living walls and green roofs, provide insulation and habitats for wildlife, promoting thriving urban ecosystems.

1.5 Policy and Regulatory Framework

A supportive policy framework is crucial for unlocking the potential of residential agriculture. Governments can facilitate this through zoning reforms, incentives, and educational programs. Collaborative efforts among various stakeholders are essential for successful implementation, promoting community gardens and shared farming spaces.

2. Methodology

Our research employed a qualitative case study approach, focusing on semi-structured interviews and comprehensive analysis of residential design integration. We conducted interviews with urban agriculture pioneers and residential design experts, gathering insights on the necessity and feasibility of urban agriculture in residential spaces.

2.1 Interview Design

The semi-structured interviews allowed for flexibility while covering essential topics, including motivations for urban agriculture, perceived benefits, challenges faced, and community engagement strategies. Each interview was approximately 30-45 minutes long, recorded, and transcribed for analysis.

2.2 Case Studies

We analysed several successful integrations of vertical farming, hydroponics, and aeroponics in residential settings. These case studies provided concrete examples of how urban agriculture can be effectively implemented, showcasing varied designs and technologies.

2.3 Data Analysis

Thematic analysis was utilized to identify patterns and insights from the interview data. We looked for common themes related to mental health, community engagement, and environmental impact, drawing links to existing literature.

2.4 Assessing Mental Health

Mental health benefits were assessed through qualitative feedback from interview participants, focusing on perceived improvements in well-being due to access to green spaces and community involvement in urban agriculture.

2.2 Findings

Integrating vertical farming and hydroponics into residential design yields numerous benefits, including enhanced crop yields and water efficiency. The fusion of these technologies promotes mental health by providing green spaces, thus fostering community engagement. Figures linked to specific findings illustrate the positive impacts of urban agriculture on air quality, community health, and biodiversity.

Water Requirements and Orientation

The water requirements for these species can be minimized through efficient irrigation systems inherent in hydroponics and aeroponics. Ideal orientation for the facades would maximize sunlight exposure, ensuring optimal growth conditions.

Additional Benefits of Wall Vegetation

Beyond food production, wall vegetation provides shading, reduces heat islands, and enhances building insulation. It also promotes biodiversity by creating habitats for local wildlife.

2.3 Conclusion

The synergy of urban agriculture and residential design presents a transformative solution to food insecurity and urban sustainability. By integrating productive ecosystems into our living spaces, we can revolutionize food access, public health, and our relationship with nature. A holistic approach encompassing technological advancements, policy frameworks, and community engagement is essential to unlock the full potential of residential agriculture. Through collaborative efforts, urban dwellers can become self-sufficient food producers, fostering a resilient and sustainable future.

3.1 Figures and Tables

1. How often do you purchase fresh produce?
25 responses

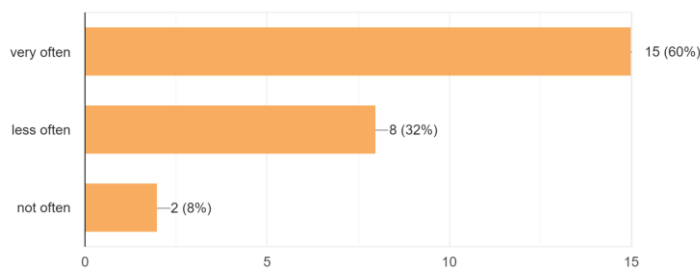


Figure 1. Showed feedback from interview questions

2. How important is having access to fresh produce in your neighborhood? (Scale: 1-5)
25 responses

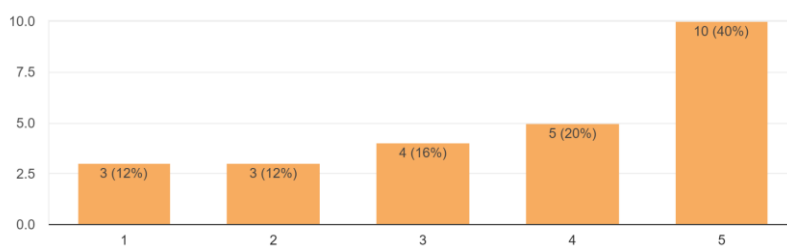


Figure 2. Showed feedback from interview questions

7. What factors would influence your decision to participate in urban agriculture or community gardening? (Select all that apply)
25 responses

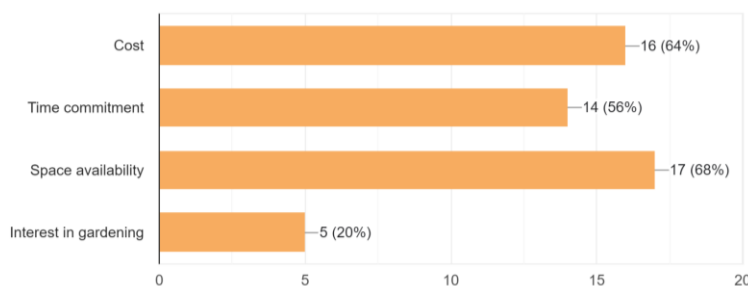


Figure 2. Showed feedback from interview questions

3. Have you ever participated in urban agriculture or community gardening? (Yes/No)
25 responses

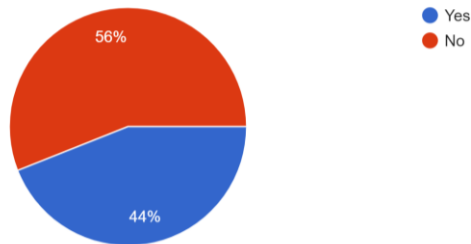


Figure 3. Shows factors influencing low participation in urban agriculture

3.2 Case Study

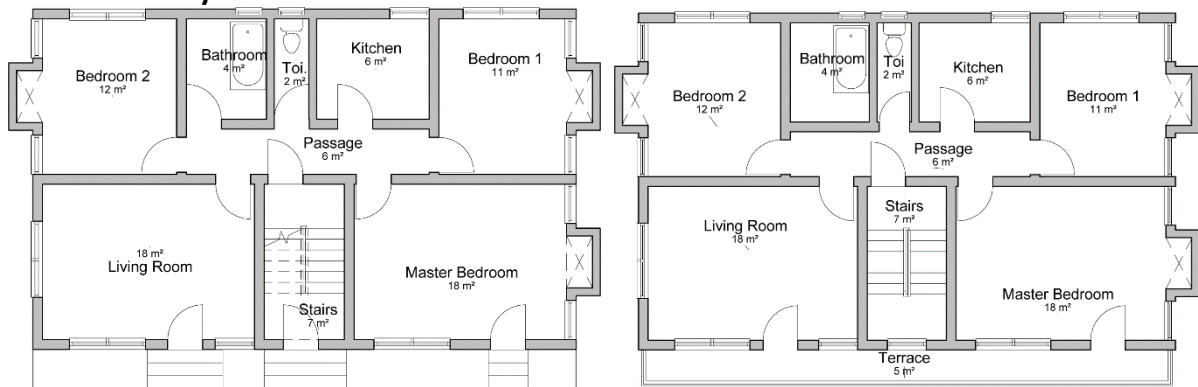


Figure 6. Showing Ground and First Floor of a Typical Residential Building in Lagos, Nigeria

This figure below illustrates a residential facade featuring vertical farming systems. We recommend incorporating species such as leafy greens (e.g., kale, spinach), herbs (e.g., basil, mint), and fruiting plants (e.g., cherry tomatoes).



Figure 7. Showing a redesigned Ground and First Floor of Case Study to inculcate urban Agriculture



Figure 5. Showing 3D view of Residential Apartment that has been transformed by Design to provide not just aesthetic, but food security loaded with health benefits

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