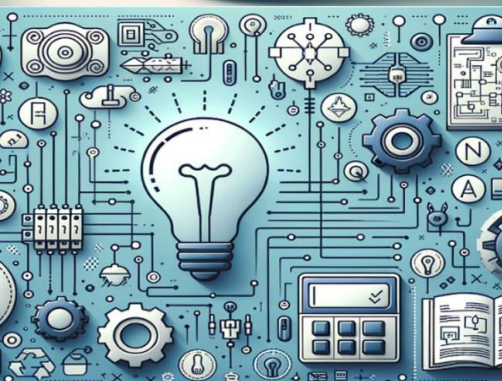


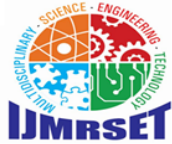
International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.206

Volume 8, Issue 4, April 2025



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Urban Rooftop Farming in Bangalore: A Condensed Analysis of Sustainability and Economic Viability

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ABSTRACT: This research examines the emerging sector of urban rooftop farming in Bangalore, India, focusing on sustainability practices and economic viability. Through analysis of data from five established rooftop gardening firms—My Dream Garden, Squarefoot Farmers, GreenMyLife, Urban Mali, and Gardening Wizards—this study provides insights into the current state, challenges, and future prospects of urban agriculture in one of India's fastest-growing metropolitan areas.

The research reveals significant potential for environmental sustainability and urban food security, alongside substantial economic and operational challenges impeding widespread adoption. Awareness and interest among practitioners are high, with motivations ranging from environmental sustainability to food security and economic opportunity. Sustainability approaches vary considerably, with rainwater harvesting, organic farming, and hydroponics emerging as the most common methods.

Economic analysis indicates revenue disparities (₹1,000-₹10,000+ monthly), with profitability influenced by scale, crop selection, and market access. Firms utilizing specialty crops, modern farming techniques, and diverse distribution channels demonstrate higher revenue potential. However, high initial setup costs are universally identified as the primary barrier to entry and expansion.

For mainstream adoption and economic viability, stakeholders recommend increased government support through subsidies and incentives, expanded training programs, improved access to farming supplies, and community-based collaborative initiatives. While rooftop farming represents a promising approach to urban sustainability in Bangalore, its transition from niche practice to mainstream solution requires coordinated interventions across policy, technical, and economic domains.

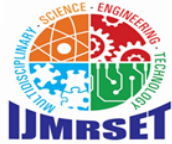
KEYWORDS: Rooftop Farming, Urban Sustainability, Economic Viability, Hydroponics, Rainwater Harvesting

I. INTRODUCTION

Urban agriculture has emerged globally as a solution to various challenges confronting contemporary cities, including food insecurity, environmental degradation, and climate change effects. Rooftop farming represents an innovative approach, utilizing otherwise unused urban spaces while delivering multiple environmental, social, and economic benefits.

Bangalore, often referred to as India's "Garden City" and "Silicon Valley," presents a fascinating context for studying urban agriculture. As one of the fastest-growing metropolitan areas in India, Bangalore has experienced rapid urbanization that has transformed its once abundant green spaces into concrete landscapes, bringing significant challenges:

1. **Diminishing green cover:** Bangalore has seen its green cover decrease from 68% in 1973 to approximately 25% in recent years.



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2. **Food security concerns:** Urban residents increasingly rely on food transported from distant regions, raising concerns about carbon footprints and food freshness.
3. **Urban heat island effect:** Bangalore experiences temperature increases of 2-3°C compared to surrounding rural areas.
4. **Water scarcity:** Despite being historically known for its lakes and gardens, Bangalore faces significant water management challenges.

Against this backdrop, rooftop farming offers a potential approach to address multiple urban challenges simultaneously by transforming unused rooftop spaces into productive green areas.

Research Objectives

1. Assess current awareness, interest, and motivations driving rooftop farming adoption in Bangalore.
2. Document and evaluate sustainability practices employed, including growing methods and resource management.
3. Analyze economic viability of different rooftop farming models.
4. Identify key challenges and barriers impeding widespread adoption.
5. Develop evidence-based recommendations to enhance sustainability and economic viability.

II. RESEARCH METHODOLOGY

Research Design and Approach

This study employed a mixed-methods research design combining qualitative and quantitative approaches. A case study approach examined five established rooftop gardening firms in Bangalore as representative cases illuminating different approaches to urban rooftop farming.

Sampling Strategy

Purposive sampling selected five rooftop gardening firms representing diverse approaches to urban agriculture in Bangalore. Selection criteria included:

1. Geographic location within Bangalore metropolitan area
2. Minimum two years of operational experience
3. Commercial orientation (partially or fully)
4. Diverse approaches to rooftop farming (technical methods, business models)

The selected firms were:

1. **My Dream Garden** - Founded by Rajesh Kumar, focuses on promoting sustainable urban farming and self-sufficiency through hydroponics and organic farming methods.
2. **Squarefoot Farmers** - Co-founded by Ananya Mehta, emphasizes community-based rooftop farming using aquaponics and organic soil-based methods.
3. **GreenMyLife** - Led by Dr. Ramesh Varma (Head Agronomist), integrates greenery in urban landscapes using solar-powered irrigation, composting, and microgreens production.
4. **Urban Mali** - Represented by Priya Sharma (Sustainability Consultant), promotes biodiversity and food sustainability through native plant-based farming.
5. **Gardening Wizards** - Founded by Vikram Das (CEO), transforms unused rooftops into productive spaces using hydroponics and soil-less gardening techniques.

Data Collection Methods

Primary data was collected through structured interviews with representatives from each firm, conducted between January and March 2025. The interviews followed a structured protocol organized around five key thematic areas: awareness and interest, sustainability practices, economic viability, challenges, and future prospects.

Secondary data was gathered from company documents, published reports on urban agriculture, academic literature, and government documents related to urban agriculture policies.

III. DATA ANALYSIS AND FINDINGS

Awareness and Interest in Rooftop Farming Motivations and Driving Factors

The analysis revealed diverse motivations driving engagement in rooftop farming across the five firms:



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Environmental Sustainability Focus: Firms like My Dream Garden and Urban Mali emphasized environmental sustainability as their primary motivation, highlighting concerns about urban heat island effects, biodiversity loss, and carbon footprints.

Community and Food Security Orientation: Squarefoot Farmers positioned their approach around community development and food security concerns, focusing on collective action and local food production.

Technological and Innovation Focus: GreenMyLife and Gardening Wizards demonstrated stronger orientations toward technological innovation and transformation of urban landscapes through modern farming techniques.

Target Markets and Beneficiaries

The firms targeted different market segments:

- **My Dream Garden:** Individual households interested in self-sufficiency
- **Squarefoot Farmers:** Community groups and residential complexes
- **GreenMyLife:** Both individual clients and institutional customers
- **Urban Mali:** Environmentally conscious households
- **Gardening Wizards:** Commercial clients looking for rooftop utilization

Sustainability Practices

Growing Methods and Techniques

The analysis revealed diverse sustainability practices with varying degrees of technological sophistication and resource efficiency:

Soil-Based Systems: Traditional soil-based methods were employed by Urban Mali and partially by Squarefoot Farmers, incorporating organic amendments and companion planting.

Hydroponic Systems: My Dream Garden and Gardening Wizards utilized hydroponic systems, reducing water usage by 70-90% compared to conventional farming.

Aquaponic Systems: Squarefoot Farmers uniquely employed aquaponics, combining fish cultivation with plant production in a symbiotic system.

Microgreens Production: GreenMyLife specialized in microgreens production, requiring minimal space and resources while potentially delivering high nutritional value.

Resource Management Practices

Water Conservation: Various approaches included:

- Rainwater harvesting systems (My Dream Garden, Urban Mali, GreenMyLife)
- Drip irrigation (all five firms)
- Recycled greywater utilization (partially by GreenMyLife)
- Solar-powered irrigation systems (GreenMyLife and Gardening Wizards)

Energy Efficiency: Energy considerations included:

- Solar power utilization (GreenMyLife and Gardening Wizards)
- Passive design elements to reduce energy requirements (Urban Mali)
- Integration with building energy systems (partially by Gardening Wizards)

Waste Management: Approaches included:

- On-site composting (all five firms)
- Vermiculture (My Dream Garden and Urban Mali)
- Integration with broader waste management systems (partially by Squarefoot Farmers)

Biodiversity and Ecological Considerations

Approaches to biodiversity varied significantly:

- Urban Mali emphasized native plant species to support local ecosystems
- Squarefoot Farmers incorporated natural pest control methods and beneficial insects
- My Dream Garden practiced crop rotation and diversity
- GreenMyLife focused on integration with broader urban green infrastructure



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Economic Viability

Investment Requirements

Initial Setup Costs:

- Basic soil-based systems (Urban Mali): ₹5,000-15,000 per 100 sq. ft.
- Intermediate systems with partial technology integration (Squarefoot Farmers, GreenMyLife): ₹15,000-30,000 per 100 sq. ft.
- Advanced hydroponic systems (My Dream Garden, Gardening Wizards): ₹30,000-60,000 per 100 sq. ft.

Ongoing Operational Costs:

- Urban Mali and GreenMyLife: ₹1,000-3,000 monthly
- Squarefoot Farmers and My Dream Garden: ₹3,000-5,000 monthly
- Gardening Wizards: ₹5,000-8,000 monthly

Revenue Streams and Profitability

Revenue Ranges:

- Lower range (₹1,000-5,000 monthly): GreenMyLife, Urban Mali
- Middle range (₹5,000-10,000 monthly): Squarefoot Farmers, My Dream Garden
- Higher range (above ₹10,000 monthly): Gardening Wizards

Revenue Sources:

- Direct consumer sales (all five firms)
- Local farmers' markets (Squarefoot Farmers, My Dream Garden)
- Restaurant and cafe supply (Squarefoot Farmers)
- Online platforms (Gardening Wizards)
- Value-added products (partially by GreenMyLife)
- Educational services and consulting (partially by Urban Mali)

Profit Margins:

- Urban Mali and GreenMyLife: 10-20% profit margins
- Squarefoot Farmers and My Dream Garden: 20-30% profit margins
- Gardening Wizards: 30-40% profit margins for specialized crops

Break-Even Analysis:

- Basic systems (Urban Mali): 12-18 months
- Intermediate systems (Squarefoot Farmers, GreenMyLife): 18-24 months
- Advanced systems (My Dream Garden, Gardening Wizards): 24-36 months

Factors Influencing Economic Viability

- **Crop Selection:** Firms focusing on high-value, specialty crops reported higher revenue potential.
- **Scale Efficiency:** Larger operations generally reported better economics due to efficiency gains.
- **Market Access:** Direct marketing channels and premium market access were associated with higher revenue.
- **Technological Efficiency:** More technologically advanced systems required higher initial investment but often achieved better resource efficiency.
- **Diversified Revenue Streams:** Firms incorporating multiple revenue streams reported more stable economic outcomes.

Challenges in Rooftop Farming

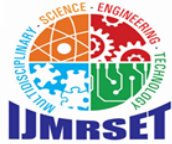
Technical and Operational Challenges

Infrastructure Limitations:

- Limited water access and pressure in some buildings
- Inadequate drainage systems
- Lack of appropriate shade or protection from extreme weather
- Limited electricity access for powered systems

Climate and Environmental Factors:

- Seasonal water scarcity during dry months
- Intense rainfall during monsoon season requiring adequate drainage
- Temperature fluctuations affecting certain crops



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- Urban pollution impacts on crop quality

Knowledge and Skill Gaps:

- Limited technical expertise among new practitioners
- Insufficient understanding of appropriate crop selection
- Challenges in diagnosing and addressing plant diseases
- Limited awareness of optimal resource management practices

Economic and Financial Challenges

High Setup Costs: Initial setup costs were universally identified as a primary barrier, including:

- High upfront investment requirements for quality materials
- Limited financing options specifically designed for urban agriculture
- Uncertain return on investment deterring potential practitioners
- High costs of quality inputs (seeds, growing media, etc.)

Market Access and Competition:

- Limited consumer awareness of urban-grown produce benefits
- Price competition from conventional agricultural products
- Inconsistent supply limiting access to commercial markets
- Logistical challenges in distribution and marketing

Regulatory and Policy Challenges

Building Regulations:

- Unclear building codes regarding rooftop modifications
- Landlord restrictions on rooftop usage
- Concerns about liability and insurance

Agricultural Policy Gaps:

- Limited recognition of urban agriculture in agricultural policies
- Absence of standards or certifications specific to urban-grown produce
- Limited access to agricultural subsidies and support programs
- Inadequate urban planning integration of food production

Future Prospects and Recommendations

Stakeholder Recommendations

Government Support and Policy Initiatives:

- Dedicated subsidies for rooftop farming setup and maintenance
- Integration of rooftop gardens into green building standards
- Tax incentives for buildings incorporating productive green roofs
- Municipal programs supporting urban agriculture

Training and Capacity Development:

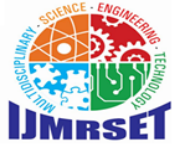
- Practical workshops on rooftop farming techniques
- Demonstration sites showcasing different approaches
- Extension services specifically targeting urban cultivators
- Integration of urban agriculture into educational curricula

Supply Chain and Market Development:

- Development of specialized urban produce markets
- Certification standards for urban-grown produce
- Digital platforms connecting urban farmers to consumers
- Integration with existing farmers' market networks

Community-Based Initiatives:

- Cooperative models for shared resources and marketing
- Community-supported agriculture adapted to urban contexts
- Neighborhood-scale composting and resource sharing
- Collective purchasing to reduce input costs



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Emerging Trends and Innovations

Technological Integration:

- Automated irrigation and monitoring systems
- Internet of Things (IoT) applications for urban farming
- Mobile applications for farm management and marketing
- Vertical farming adaptations for rooftop spaces

Business Model Innovation:

- Rooftop-to-table restaurant partnerships
- Subscription services for urban-grown produce
- Integrated service models combining installation and maintenance
- Educational tourism focused on urban agriculture

Ecological Integration:

- Rooftop biodiversity corridors
- Integration with building energy systems
- Rainwater harvesting synergies
- Urban cooling through strategic green infrastructure

Social Innovation:

- Cooperative ownership and management models
- Intergenerational knowledge transfer programs
- Cultural heritage preservation through indigenous crop cultivation
- Social enterprise approaches combining commercial and community benefits

IV. RECOMMENDATIONS FOR SECTOR DEVELOPMENT

Policy and Regulatory Recommendations

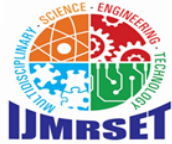
1. **Dedicated Urban Agriculture Policy:** Develop a comprehensive urban agriculture policy that explicitly recognizes and supports rooftop farming, providing clear guidelines, standards, and support mechanisms.
2. **Green Roof Incentives:** Implement financial incentives (tax rebates, subsidies) for buildings incorporating productive green roofs, potentially integrated with existing green building certification systems.
3. **Building Code Clarification:** Review and adapt building codes to explicitly address rooftop farming, providing clear guidelines for structural requirements, safety standards, and permissible modifications.
4. **Urban Planning Integration:** Incorporate urban agriculture, including rooftop farming, into urban development plans, potentially designating zones for intensive urban food production.

Economic and Financial Recommendations

5. **Startup Subsidy Program:** Establish a dedicated subsidy program to offset initial setup costs for rooftop farming initiatives, particularly targeting residential complexes and community groups.
6. **Specialized Microfinance:** Develop specialized microfinance products designed for urban agriculture initiatives, with appropriate terms reflecting the sector's investment-return profile.
7. **Market Development Support:** Create infrastructure supporting urban produce markets, including dedicated market spaces, digital platforms connecting producers and consumers, and certification standards for urban-grown produce.
8. **Value Chain Development:** Support the development of complete value chains for urban produce, including processing, packaging, and distribution infrastructure appropriate to urban contexts.

Technical and Educational Recommendations

9. **Demonstration Sites Network:** Establish a network of demonstration sites showcasing diverse approaches to rooftop farming, providing practical examples and learning opportunities.
10. **Technical Training Programs:** Develop targeted training programs addressing key knowledge gaps, including crop selection, pest management, water conservation, and system maintenance.
11. **Extension Services Adaptation:** Adapt agricultural extension services to specifically address urban farming contexts, potentially through dedicated urban agriculture extension officers.



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12. **Research and Development Support:** Provide funding and institutional support for research and development focused on rooftop farming innovations specifically suited to Bangalore's climate, building stock, and market conditions.

Social and Community Recommendations

13. **Community Coordinator Program:** Establish a program of community farming coordinators who can facilitate the development of shared rooftop gardens, particularly in residential complexes.
14. **Resource-Sharing Platforms:** Support the development of platforms enabling sharing of tools, knowledge, seeds, and other resources among urban farmers.
15. **School Integration Program:** Integrate rooftop farming into school curricula and facilities, providing educational opportunities while developing future practitioners.
16. **Cultural Integration Initiative:** Develop programs celebrating and preserving cultural food heritage through urban agriculture, particularly focusing on traditional crops and cultivation methods.

V. CONCLUSION

This research provides a comprehensive analysis of urban rooftop farming in Bangalore through case studies of five established firms. The findings reveal a sector with significant potential for contributing to urban sustainability and food security, but facing substantial economic and operational challenges that impede widespread adoption.

The diversity of approaches documented—ranging from traditional organic methods to advanced hydroponic systems—demonstrates the flexibility of rooftop farming to adapt to varying contexts, priorities, and resources. This adaptability represents a strength for the sector's development, allowing for innovation and contextual appropriateness rather than rigid standardization.

Economically, while some operations are achieving commercial viability with revenues exceeding ₹10,000 monthly, others struggle to move beyond subsistence levels. The critical factors influencing economic outcomes include crop selection, scale, technological efficiency, market access, and revenue diversification. The extended payback periods (12-36 months) highlight the importance of patient capital and appropriate financing mechanisms.

The challenges facing the sector span technical, economic, regulatory, and social domains, with high initial setup costs universally identified as the primary barrier to entry and expansion. The interconnected nature of these challenges suggests that addressing any single barrier in isolation is unlikely to be sufficient; instead, comprehensive, multi-domain approaches are necessary.

While rooftop farming represents a promising approach to urban sustainability in Bangalore, its transition from niche practice to mainstream solution requires coordinated interventions across policy, technical, and economic domains. With appropriate support and innovation, rooftop farming has the potential to contribute significantly to a more sustainable, resilient, and food-secure urban future.

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