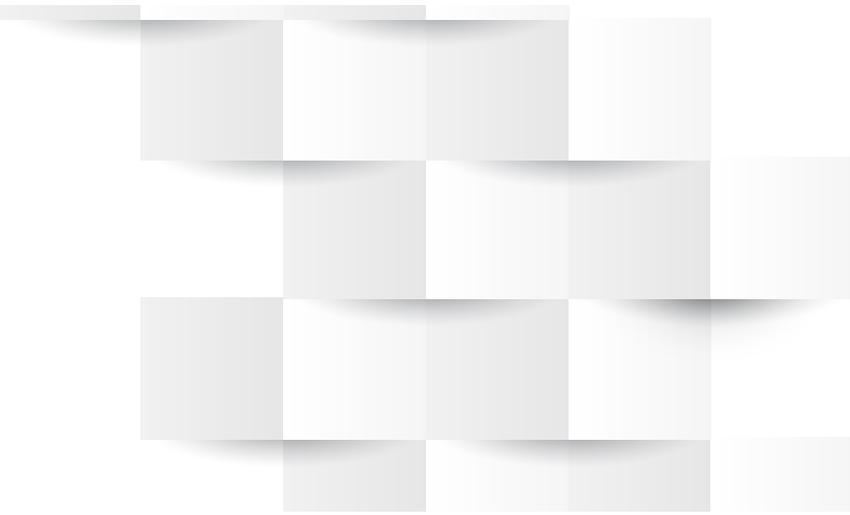




# Beyond Covid 19: A Case For Urban Farming

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# Executive Summary

The COVID-19 pandemic and the antecedent restrictions on goods and services has claimed its toll on Supply chains across various sectors of daily life. The Agricultural sector like most key sectors has had its fair share of supply-oriented challenges. The Pandemic has harshly exposed the gaps in the supply chains of most commodities which had hitherto relied on rural production and supply infrastructure to meet urban household, and peri-urban industry demands. With an urban population of 51.2% and rapidly increasing at 4.3% annually, the absolute reliance on rural production to meet urban food demand in Nigeria has been exposed as being unsustainable to say the least. As part of our BEYOND COVID 19: AGRICULTURAL INSIGHTS series<sup>1</sup>, we have highlighted nine (9) innovative opportunities which can be explored to ensure sustainable remedies to the challenges faced by agricultural value chains in Nigeria. Using findings from existing literature, a comprehensive overview of domestic policy and socio-economic space, industry insights from key players across value chains, referencing case studies from peer developing economies alongside domestic pioneers, and assessment of available technology. Insights are tailored for; policy makers, private enterprises, donor agencies and the general public, on innovations for scale to remedy identified challenges in the Nigerian agricultural sector.

This article analyzes the viability of URBAN FARMING as a scalable solution to food security challenges in our urban centers. We highlight the various types of Urban farming techniques, the socio-economic benefits they portend in the Nigerian context, the challenges, and limitations of adopting urban farming, with recommendations on policies and actionable steps to enable adaptation of the techniques. A Strength, Weakness, Opportunities, and Threats (SWOT) analysis is also carried out to give an objective insight into the viability of Urban Farming in Nigeria. With tangible opportunities identified as; Huge population (approximately 206 million), a large number of urban dwellers (51.2%), a sizeable food consumption bill (56.65% of domestic consumption), a large labor force (62.26% of the population under the age of 25 with a median age of 18.3 years), a significant number of abandoned and underutilized buildings and spaces in most cities, and socio-economic variables (such as 60-80% of the urban population being in the informal sector).

We have identified; Mixed vertical farming, community farms, institutional farms, rooftop/vacant lots farming, and Agro Parks as having evident potential for scale. Subsidizing solar energy inputs, adopting an Urban Farming policy, and integration of Urban Farming techniques as part of entrepreneurial training, are among the recommendations proffered to facilitate the sustainable scaling of urban Farming in Nigeria.

# Urban Farming Overview

Urban farming is the use of urban spaces leveraging innovative technology to maximize output utilizing very limited or no land resources. Some of these methods include; Vertical farming, urban greenhouses, rooftop/vacant lot farming, allotment gardens, institutional farms, etc. These techniques are easily applicable and feasible to scale up, as they use; public spaces, containers, rooftops, abandoned buildings, and even backyards for production. Urban Farming is already practiced by many forward-looking cities that aim to achieve food security and tap into portending socio-economic benefits.

## Types Of Urban Farming

### 01. Vertical Farming

Vertical farming is a form of Controlled Environment Agriculture (CEA) that consists of fully insulated indoor operations, producing crops on multiple levels solely using electrical lighting. Vertical farms have been widely regarded as feasible and scalable solutions to many environmental and economic issues in food production<sup>2</sup> In part, because they are protected from the outside environment, and can be constructed in even the most extreme environmental conditions<sup>3</sup>. The types of vertical farming techniques with marked potential for scale in Nigeria include; Hydroponics, Aquaponics, and Aeroponics.



**Vertical Farm Using Containers**

Credit: Fresh Direct farms

**Hydroponics:** This method involves the growing of plants in a controlled environment without the use of soil. The crops are grown in a solution of nutrients that are constantly circulated to ensure the chemical composition of the soluble nutrients is efficiently balanced.



### Hydroponics Farm Structure

Credit: Fresh Direct farms

The advantages of hydroponics systems include; Higher yield compared to conventional farming, fewer pests due to minimal soil use, all year production from indoor growth, a faster growth rate of crops, and it is ideal for leafy and fruiting crops since fewer nutrients are needed for root growth<sup>4</sup>. Limitations of the system include; high cost of equipment, high maintenance cost (time and expertise), and smaller roots might lead to unbalanced crops especially with heavy fruits, thus requiring elaborate forms of support<sup>5</sup>.

**Aeroponics:** This is an evolution of the hydroponics system, as it eliminates the use of soil from the growth process, leaving the roots to dangle in the air, where they are periodically puffed by specially-designed misting devices. Seeds are “planted” in pieces of foam fitted into tiny pots, which are exposed to light on one end and nutrient mist on the other. The foam holds the stem and root mass in place as the plants grow.

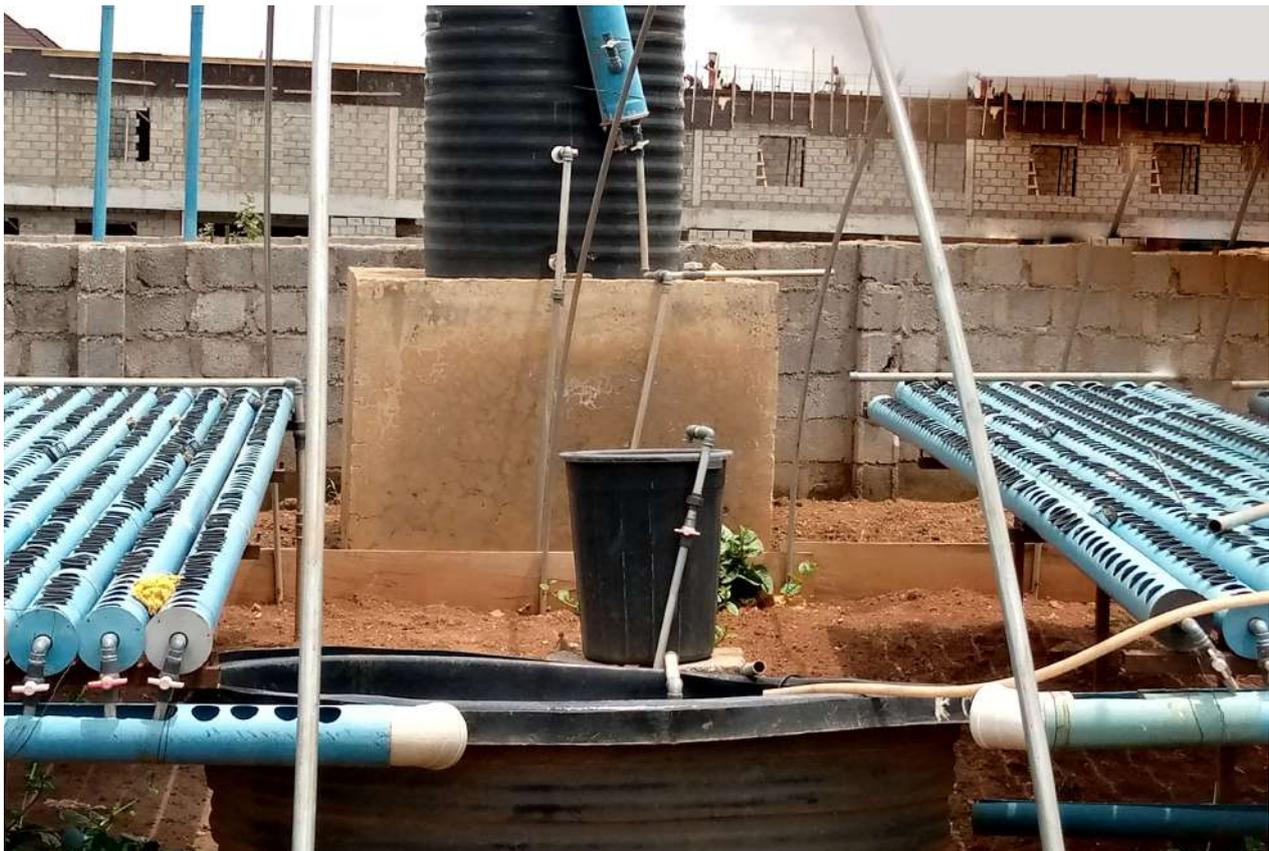


### **Aeroponics System**

Credit: Fresh Direct farms

Aeroponics has proven advantages which include; faster growth rate due to increased oxygen exposure, less water consumption, nutrient recycling, larger yield size/density, and reduced use of agrochemicals like herbicides, pesticides, and insecticides since growing equipment can simply be sterilized<sup>6</sup>. The limitations of aeroponics include; aeroponics is reliant on power which is erratic at best in Nigeria (solar power can however be leveraged to negate energy cost), High cost of initial setup and it requires intensive expert care<sup>7</sup>.

**Aquaponics:** Aquaponics is a farming method that combines the benefits of aquaculture and hydroponics. A nitrifying bacterium converts fish waste which serves as an organic nutrient source for the plants. The water passes through a hydroponic plant-growing section for filtration which is recirculated back in the fish tank for reuse. With a natural ecosystem that recycles water continuously, an aquaponics system uses 90% less water than traditional farming<sup>8</sup>. Additionally, the system is self-sustaining which requires low maintenance and zero pesticides, fertilizers, or herbicides.



### Aquaponics System

Credit: Fresh Direct farms

The main limitations of this system are that; the often-practiced single loop system has challenges in optimizing both fish and plant yields as water quality and nutrient levels differ for both products and have to be closely monitored, and it is highly reliant on a consistent power supply<sup>9</sup>. There are numerous successful enterprises practicing aquaponics worldwide with the global industry currently valued at \$523.7 million and projected to reach \$870 million by 2022<sup>10</sup>. In Nigeria, companies are pioneering the technology such as; AQUAPONICS NIGERIA<sup>11</sup> in Uyo Akwa-Ibom State, which can serve as a scalable reference.

## 02. Community Farms

A community farm is a multi-functional farm where the land is held “in trust” for a community rather than owned privately. A community group or co-operative governs the land use agreements, and agricultural uses of the land are shared by a community of farmers. The primary focus of a community farm is local food production using sustainable agricultural practices<sup>12</sup>. This system is mainly based on organic farming techniques and can be applied using either open field or greenhouse systems. The advantages of this system of farming include; job creation, promotion of innovative techniques, community building, food quality, food security, health benefits, training, and education of the farm community<sup>13</sup>

A good example of the efficient use of community farming is in Cuba, where in the aftermath of the Cold war, with the stringent trade restrictions imposed. The citizens encouraged by the government, established an allotment system (land issued to communities with incentivized target crops) and by 2008, 90% of fruits and vegetables consumed were from urban community farms on just 8% of the total landmass<sup>14</sup>. This was facilitated by prudent use of resources, training, and social cohesion. Practices which if properly adopted can be effectively applied in the Nigerian context.

## 03. Commercial Urban Farms

This involves commercial food production by professional farmers using intense and advanced growing systems<sup>15</sup>. The system uses modern inputs and technology such as greenhouses, drip systems and temperature control to produce staples to meet urban market demands. They are usually set up by private enterprises to take advantage of supply gaps, and the high purchasing power of urban dwellers. The system, however, faces limitations which include; high set up and operational cost, lack of adequate cold supply chains, the unfavorable purchase price to average urban dwellers, seed supply challenges, and market competition from cheaper but inferior foreign Genetically Modified crops (GM crops). Which have limited the scale impact of this system thus far in Nigeria.

There are numerous commercial urban farms operating in Nigeria such as TENTI GREENS farms in Jos Plateau State. The number and spread of these farms have however proven insufficient to meet urban consumption, with a greater cross-sectoral investment needed to ensure food resilience and security nationwide.

12 <https://www.communityfarms.ca/>

13 <https://www.theecologycenter.org/10-ways-urban-farms-benefit-the-community/>

14 The post-Cold War Cuban food experiment. RAPID TRANSITION ALLIANCE(RTA). September 2019.

<https://www.rapidtransition.org/stories/the-post-cold-war-cuban-food-experiment/>

15 PULIGHE, G. & LUPIA, F. (2016), 'Mapping spatial patterns of urban agriculture in Rome (Italy) using Google Earth and web-mapping services', Land Use Policy, 59 (1), pp. 49–58

## 04. Rooftop/Vacant Lots Farming

As implied by the name, this system uses rooftops and vacant lots for food production utilizing various farming techniques that maximize output in limited space, such as vertical farming techniques and crate farming. This system's main advantage, apart from the fact it uses up space which would have been lying idle, is the effective use of household waste as compost in food production which can aid in city waste management. It also enhances urban landscapes and makes them more eco-friendly. Rooftop farming has been widely accepted in both developed and developing cities across the globe, as a possible solution to urban food shortages, and environmental challenges.

Examples include; 'Brooklyn Grange' the world's largest rooftop garden in New York<sup>16</sup>, 'Dakpark' in Rotterdam, a vegetable garden, restaurant, and park on top of a shopping center. And Aeroroots Pvt Ltd which has successfully applied its 'Aerorooft' systems in Godawari, Nepal. While there are noted limitations such as; effect of rooftop farming on weight and structure of building roofs, high cost of membrane (water systems) installation, and insurance/safety issues. This system will be very helpful in high population-dense cities with a significant number of high-rises such as; Lagos, Abuja and Port Harcourt to ensure sustainable fresh food for residents and restaurants.

## 05. Agro Parks

These are clusters of agricultural activities where various links of the food chain are located in close proximity. The concept has been developed to apply industrial ecology in the agricultural sector<sup>17</sup>. The benefits of this system include; creating a closed production system where inputs and outputs of value chains are maximized, reduction in transport cost, biodiversity/ecological benefits, bridging the gap between producer and consumer, and sustainable socio-economic environments. The limitations of this system's adaptation in Nigeria include; Insufficient volume/ varieties of crops for processing, high production cost, inadequate infrastructure for scale, bureaucratic bottlenecks, low yields and post-harvest losses, unfavorable tax policies, a shortage of skilled labor and inadequate quality control.

A great example of successful implementation of this system is the 'Bio-Park Terneuzen' in the Netherlands, where the company 'WarmCO2'<sup>18</sup> produces vegetables in glasshouses using the heat and carbon dioxide (CO<sub>2</sub>) from industrial companies next door at the same industrial site<sup>19</sup>. A similar system can be adopted where various value chain industries can be co-located in a specific hub (e.g. Sugarcane hub in Adamawa State, Yam/fruit hub in Benue State) to ensure effective supply chains and reduced logistical cost of goods.

## 06. Agro Tourism/Community Gardens

This involves farming in agricultural recreational parks in peri-urban locations combined with the provision of facilities and services for urban tourists (e.g. food, accommodation, guided tours, and horse riding).

The benefits of this system can be classified into; benefits to farmers, benefits to the general public, and socio-economic benefits. Benefits to farmers include; direct marketing, additional income avenue, increased profits, interaction with customers, and seasonal flexibility. Benefits to the general public include; transparency of food source, education on farming practices, and outdoor recreation. Socio-economic benefits include; improved farmer-community relationship, promotion of smallholder communities, and increased sale of local products/services. The limitations to adapting this system include; low initial financial returns, it is labor and time-intensive, requires bespoke laws and regulations, high risk of crop damage from tourist activity, vulnerability to economic downturns, loss of farmer privacy, and lack of customer (tourist) awareness.

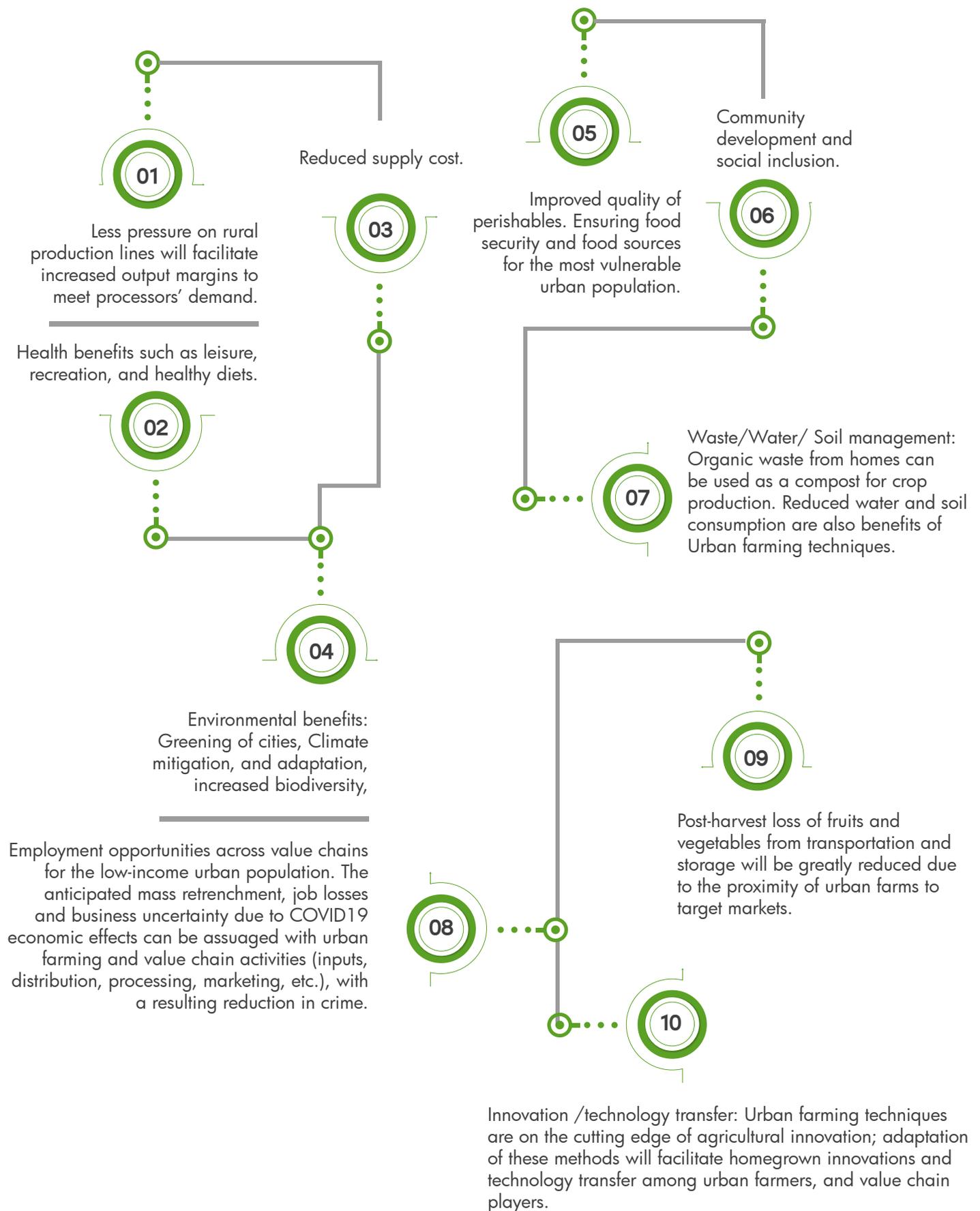
A great example of a successful Agro tourism venture, is the Tangaro farm in Magaliesberg, South Africa<sup>20</sup>. Which provides strawberry picking and picnic services along with other tourist attractions including; a hotel, restaurants, hot air ballooning, a golf course, and a shooting range. This can be adopted in peri-urban areas with unique vegetative and climatic environments such as; Mambilla Taraba State, Vom Plateau State, Obudu Cross-Rivers State, etc. To provide extra revenue for cities while simultaneously ensuring food security, and improved health for surrounding urban citizenry.

## 07. Institutional Farms

This is food production and management by institutes, such as schools, hospitals, prisons, and other non-profit organizations. Institutional farms have been adopted by many cities and institutions to ensure economic viability, and to serve surrounding communities. Concurrently, achieving social cohesion in the institutions. Examples of successful institutional farms include; UrbanFarmers AG<sup>21</sup> a spin-off from the University of Applied Sciences in Wädenswil, which runs the UF001 LokDepot rooftop farm in Basel Switzerland, and Brickborn Farming which was developed by researchers from the University of Applied Sciences Dresden, Germany<sup>22</sup>.

This system can be adopted by institutions in Nigeria (e.g. by schools as part of the school feeding program) to cut down their consumption cost and ensure sustainable, self-reliant food systems in the short term, with successful projects scaled up to provide commercial revenue earnings.

# Benefits Of Urban Farming



# Challenges/Limitations

Urban farming is generally not suitable for plants that require vast acreage due to land limitations in urban areas. Grains such as rice, corn, sorghum, etc. will still have to be grown in rural or peri-urban areas.



The risk of water and soil contamination from the use of agrochemicals. This can however be assuaged by encouraging organic farming techniques and systematically prohibiting the use of agrochemicals over a while.

Operational cost: energy, infrastructure, and management cost are high. Solar power can be a suitable energy alternative.



A lack of community structures across urban areas in Nigeria might prove challenging.

Illiteracy/lack of skills: This is a challenge especially with adaptation and implementation acceptance. There has to be a targeted effort at developing orientation, and extension systems.



Plant adaptation for Closed environment agriculture: Plants will need to adapt to CEA growing conditions. Meaning, new crop genetics will need to be designed specifically for vertical farm production that addresses five traits of interest: easy and uniform fruiting; rapid biomass and multi-harvest capable crops; photoinduced quality; auto-harvest friendly traits; and dwarf plants with yield efficiency.

# Urban Farming Adaptation In Nigeria

## Strengths

- Urban farming techniques have a higher yield per land ratio than conventional farming.
- Reduced post-harvest loss in fruit and vegetable value chain. Currently 30-50%<sup>23</sup> of domestic production in Nigeria.
- Reduced supply cost and supply chain resilience.
- Improved quality of perishables and food security.
- Health benefits such as leisure and recreation.
- Community development and social inclusion.
- Innovation /technology transfer.
- Water, Land, and Waste management.
- Environmental benefits: Greening of cities, Climate mitigation and adaptation, increased biodiversity, pollution reduction.

## Opportunities

- Huge population (approximately 206 million in 2020<sup>24</sup>) with 51.2% being urban dwellers<sup>25</sup>, and an annual growth rate of 4.3%<sup>26</sup>. Food consumption accounts for 56.65% of domestic consumption<sup>27</sup>. These present a huge market opportunity for urban farmers.
- Large, youthful labor force with 62.26% of the population under the age of 25 and National median age of 18.3years<sup>28</sup>.
- 60-80% of the urban population is in the informal sector<sup>29</sup>, which accounts for 65% of GDP<sup>30</sup>. They can be trained to adopt urban farming as a revenue earner/source of employment.
- A large number of abandoned and underutilized buildings in most cities.
- Residential estates and communities can have community farms ran by residents to serve their food requirements.
- Mixed vertical farming and Agro Parks have a high potential for scale in Nigeria.
- Abundant sunlight presents a viable opportunity to explore solar power as the main urban farm energy source.

## SWOT

## Weaknesses

- Equipment cost and maintenance time are higher than traditional farming.
- The range of crops that can be grown with urban farming is limited due to space.
- Risk of water and soil contamination from the use of agrochemicals.
- Risk of Genetically Modified Crops due to Plant adaptation to enable vertical farming techniques.

## Threats

- Reduced income and opportunities post COVID-19 might see a reversal in urban migration growth, leading to the reduced labor force to implement urban farming.
- Lack of stable power and high cost of alternatives.
- A lack of policies to enforce the adaptation of urban farming will hinder its adaptation.
- High illiteracy rates and lack of skilled labor could prove challenging.
- Security of farm assets: Securing urban farms in Nigeria might also prove challenging if other socio-economic problems are not addressed.

23 Bolarin F.M, Bosa S.O, Post-Harvest Losses: A Dilemma in Ensuring Food Security in Nigeria. Journal of Natural Sciences Research. Vol.5, No.7, 2015

24 <https://www.worldometers.info/world-population/nigeria-population/>

25 Nigeria - Urban population as a share of total population: <https://knoema.com/atlas/Nigeria/Urban-population>

26 The World Factbook — Central Intelligence Agency". [www.cia.gov](http://www.cia.gov). Retrieved 10 April 2018.

27 NATIONAL BUREAU OF STATISTICS: consumption expenditure pattern in Nigeria.2019.

28 Nigeria Demographics Profile 2019: [https://www.indexmundi.com/nigeria/demographics\\_profile.html](https://www.indexmundi.com/nigeria/demographics_profile.html)

29 UNHABITAT COUNTRY PROGRAMME DOCUMENT NIGERIA: 2015-2017. [https://mirror.unhabitat.org/downloads/docs/13237\\_1\\_595875.pdf](https://mirror.unhabitat.org/downloads/docs/13237_1_595875.pdf)

30 Bank of Industry (BOI) Economic Development through the Nigerian Informal Sector: A BOI perspective. Working Paper Series: No. 2,17th May 2018

# Recommendations

- An Urban farming policy should be adopted into the urban development policy. The National Urban Development Policy (2012) is the main urban policy framework in place in Nigeria at the moment. While making provisions for green spaces and reserves, it could be amended to consider urban food security. Urban farming policies have been adopted by several developing countries to ensure food security, to feed citizens, and fight chronic hunger. Examples include; the Brazilian city of Belo Horizonte – ‘the city that ended hunger’ – and the African cities of Kampala Uganda, and Dar es Salaam Tanzania, that have integrated urban farming in their planning strategies to increase food security. The use of “estate farms” where residents of estates can grow their fresh produce for communal consumption, is a practical example of how this can be applied in the Nigerian context, and will help ‘to foster sustainable economic growth, promotes efficient urban and regional planning and development, as well as ensure improved standard of healthy living and well-being of all Nigerians’ as contained in the National Urban Development Policy, 2012.
- Include urban farming techniques into enterprise training: This can be done through the National Directorate of Employment (NDE), and Small and Medium Enterprises Development Agency of Nigeria (SMEDAN), with practical apprenticing at current urban farms. Graduates can be incentivized by agricultural credit schemes such as the Agric, Small, and Medium Enterprise Scheme (AGSMEIS). This will ensure the development of relevant skills to service urban farming enterprises.
- Mixed vertical farming systems such as hydroponics and aquaponics operating in tandem have great potential in the Nigerian context, as they ensure maximum use of resources. ‘Fresh Direct’ an Abuja based company has successfully shown the market potential of using mixed urban farming techniques. With its application of hydroponics, aquaponics, and poultry farming on a single location, using containers to maximize land use, and achieve substantial commercial output to meet the demand for fresh, organic food in the city.
- Adopt Agro-Parks for commodities that are produced with raw materials concentrated in a particular region (e.g. Ginger in Kaduna, and Vegetables in Plateau state) with various actors across the value chain in close proximity. This will significantly increase the quality and quantity of outputs, and reduce the cost of production and transportation with accompanying risk.
- Subsidize the cost of solar panels and batteries for agricultural purposes to negate the effects of lack of power for urban farming, which is highly dependent on constant energy supply. Asset-based credit can be used to negate the cost of solar equipment.
- Restaurants, hotels, and other hospitality-based enterprises should be encouraged to only use vegetables sourced from urban farms or produced by such establishments.

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