

Transforming Urban Farming Approaches to achieve the SDGs

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Abstract:

The social nature of urban farming is a major motivation for growing food in a city as individuals and organisations work towards increasing access to healthy foods and also in connecting consumers and growers. It comprises variety of livelihood systems at the household level to more commercialised level. Furthermore, urban farming involves different discipline and approaches acquiring interest and attention in the field of architectural research. The main focus of this paper is on various aspects of growing crops in urban spaces. Urban Farming involves different types of food producing Spaces, Stakeholders, Resources and Policies that contributes health, social, ecological, and economic benefits to communities. Considering this huge potential, the paper intends to provide the necessary background on the trends seen in urban agriculture in built environment in New Delhi City initiated by individuals and community groups who have started urban farms as businesses and as non-profit social enterprises. This study also highlights its contribution in achieving Sustainable Development Goals(SDGs) that promotes food security.

Keywords — Commercialisation, Community Gardens, Food Security, Sustainability, Urban Farming.

I. INTRODUCTION

Urban Farming is a complex phenomena that involves different kind of approaches and interventions such as low tech and high tech solutions that characterise the city at different scales in terms of territory, town, building, neighbourhood and house. Sometimes urban farming doesn't restrict to plants alone but also raising of animals for food and other uses within and around cities and towns. It is also to be noted that urban farming and urban agriculture definition are interchangeable. The primary aim of the paper is to analyse the current urban farming scenario in Delhi, identify the prevailing problems, constraints and suggest a way forward based on a nuanced understanding of the Sustainable Development Goals(SDGs) that will be of value to public and private bodies, including investors, researchers and technical practitioners, involved in the wide area of food and agriculture.

'Urban Metabolism,' a process which takes in people, food, resources and energy and transforms these into a distinctive quality of life emitting products and waste as a concept of input output systems. Any urban food system usually comprises complex entities that include five types of sub-systems which are production, supply, distribution, and consumption of food as well as social reproduction. SDGs formally known as '2030 Agenda' are the collection of 17 global goals and 169 targets set by UNDP (United Nations Development Programme) as a holistic approach in achieving sustainable development for all in 2015. Urban Metabolism can help achieve multiple Sustainable Development Goals as food and agriculture acts as a prime connection between people and planet.

This study attempted exploring and collecting secondary and supportive primary data accumulated from community farmers, urban farming practitioners and farming guide

consultancies through semi structured questionnaire.

This paper focuses on examining the disregarded connection amongst urbanisation and food systems particularly in the context of urban poor.

II. BACKGROUND OF THE STUDY

In reference with SDGs, urban farming and its speciality explicitly aids in End hunger, achieve food security and improved nutrition and promote sustainable agriculture (Goal 2) thus achieving other targets in SDGs. SDG-2 highlights the complex inter-linkages between food security, nutrition, rural transformation and sustainable agriculture. Beginning with the SDG-2, the study discovers the challenges faced by urban farming in achieving 'Zero Hunger' and then explores on urban farming approaches and finally, its vital role in achieving other SDGs.

A. Food Security

According to FAO's¹ Agriculture and Development Economics Division (ESA), Food security is defined as "access by all people at all times to enough food for an active, healthy life". (Krishna K et al., 2015) Food security implies three things: availability, accessibility and affordability of food in sufficient quantity and quality. (Appadurai, 1984)

Food insecurity is caused by the denial of universal rights to specific groups of people, such as the right to life-sustaining resources (Collins, 1986) or the right to participate in vital decision-making about entitlements. (Appadurai, 1984) Many cities face a situation where they are unable to manage the massive growth of its population, which leads to a decrease in urban shelter, security of tenure, backlogs in delivery of basic services, increasing inequality and

¹ *The Food and Agriculture Organisation (FAO) is specialised agency of the United Nations that leads international efforts to defeat hunger.*

segregation, degradation of the urban environment and increase in poverty, malnutrition and food insecurity. (Veenhuizen and Danso, 2007) In urban settings, lack of income interprets more directly into lack of food than in rural settings. The costs of supplying and distributing food from rural areas to the urban areas, or to import food for the cities are rising continuously and distribution within the cities being uneven. As a consequence, urban food insecurity will increase. (Argenti, 2000) The focus of sustainable agriculture tends to be on rural areas and traditional solutions to development. As modernisation overtakes both the developed and developing world, it is vital to address the importance of urban farming.

With 50% of the Indian population expected to live in cities by 2050 and change in climate has been predicted and there will be considerable undernourishment and deficiency of calorie intake in India's urban areas. (Gupta, 2013; Sahasranaman, 2016) Non-availability of land and astronomically high land prices are major concerns. FAO, in 2011-13, revealed a total of 842 million people, globally were estimated to be suffering from chronic hunger, regularly not getting enough food to conduct an active life. (Krishna K et al., 2015) The recent world food price crisis has rendered the importance of understanding and confronting the causes of food insecurity of the urban poor even more apparent. There are a number of ways through which urban agriculture can have an impact on urban food security. At the household level, urban agriculture can be a source of income that will provide direct access to a larger amount of nutritionally rich foods² and a more varied diet that increases the stability of household food consumption against the season fluctuation.

According to an economic survey 2013-2014, only 35% of the total farmland area is irrigated and approx. 75% of the total annual rainfall will impact Agriculture production. The total land

² *Nutritionally rich foods such as vegetables, fruit, meat.*

area is 2,972,892 Km² and 32.8% of the population is urban which stands at 377 million is expected to grow by 404 million by 2050. (World Urbanisation Prospects, 2014) Urban farming has a great potential to rejuvenate the rural landscape, deliver inclusive growth to countries and drive positive change right across the 2030 Agenda. Hence, it is also feasible that urban farming may also influence the attainment of a number of SDGs beyond Goal 2³.

B. The Stakeholders

People being an important factor involved in urban farming on which its impact depends on. Local residents, Volunteers, Community Organisations, Students, Visitors and Market customers are involved. The key stakeholders are Farmers and Gardeners, Government Officials, Support Organisations and Funders, Welfare Services to Non-Governmental Organisations (NGOs).

C. Approaches in Urban Farming

According to Veenhuizen & Danso the research done in U.S and Chicago three models were distinguished as most applicable and convenient to use in city planning and advocacy, based on the variables of location, size, type of management and degree of commercial orientation. (Advocates for Urban Agriculture, 2004) These models are analysed with respect to the New Delhi City urban farming initiatives.

1. Bottom - Up Approach

This approach with private and autonomous forms of urban agriculture is carried out in private residential spaces, shared building spaces and unused urban spaces. This form of urban agriculture usually aims local food production for self consumption, community involvement, food security and food justice, educational, recreational and rehabilitator activities

³ *Envision2030 Goal 2: Zero Hunger - End hunger, achieve food security and improved nutrition and promote sustainable agriculture.*

(Veenhuizen, 2007). This aims to shorten the distance between food production and consumers in order to guarantee healthy food access to citizens. Here, low tech traditional agricultural technologies are used. This approach needs institutionalisation and the local policies for the space management and space usage. (Casazza, 2016) Home gardens falls under this category where it is followed in a house or apartment managed by residents, with production primarily for home use.

2. Top-Down Approach

This approach practised at large or territorial scale in private and public spaces, aims to create social inclusion and participation, improving urban environmental quality. This approach involves public administrations or non-profit associations, children, elderly people, healthcare centres. (Golden, 2013) This approach involves high tech hydroponic technologies and devices⁴. Hydroponics is a method of growing plants with a medium other than soil; it can be peat, sand, vermiculite, etc. Here nutrient solution is used to water plants. In the purest form of hydroponics, the plant's crown is supported by small amount of substrate, as the roots are immersed in a nutrient solution. The nutrient solution is circulated through the growing medium. Since plants have different nutrient requirements during different stages of their growth, pH and nutrient solution strength need to be monitored regularly. In this community based gardens, large garden plot is subdivided into several small plots. High management skills are required to run this project. (Singh, 2006) They are either managed by members of the community with production mainly for use by the members of the households or by the institution involved. (Veenhuizen and Danso, 2007)

Edible Routes is a Delhi based start-up that creates and manages farms and urban food gardens with *top-down approach*. Based on the

⁴ *Greenhouse, growth-cell, hydroponic vase, hydroponic tower, vertical farm, and vertical green and living wall*

interview, sunlight direction is always considered as an important factor in designing a garden space says Mr. Kapil Mandawewala, the founder of Edible Routes. Insufficient sunlight makes the plant grow at slower pace. In that case, artificial light is employed to balance the growth. Another important requirement for growing plants is nutrition. The strength of Edible Routes farm is the area of the land that comprises of 3.6 hectare in which wide variety of crops is being cultivated. Instead of throwing seeds across the farming area, edible routes sows the seeds in 3 meters each. To minimise the time in watering plants the founder covers the top soil by a layer of dry leaves and wood remains (collects from nearby carpenters) to retain the soil moisture. The firm has employed regular workers who come and remove the weeds regularly and maintain the land. It is known fact that textile material like polypropylene is used in several places in India for effective weed control and to prevent soil erosion during rainfall in farmland.

3. Commercial Approach

It involves retailers, farmers, users and administration at a larger scale. This aims to create a new local economic market or network to reach a local food production to be sold at urban scale thereby creating new jobs and services. Entrepreneurs, retailers, supermarkets, restaurants and private buyers are the users involved. It usually implies highly productive harvesting methods like hydroponic technologies and hydroponic greenhouses. (Bohle, 1994) Vertical gardening utilises vertical area for growing plants. As a matter of fact, green walls differ from vertical farming.

D. Crop SELECTION

Crops selection is done while taking some factors into account such as climatic condition of the region, care and efforts required for the crop and economic feasibility (especially in case of commercial purpose). If modern techniques are adopted, then the range of crops that can be grown is wide. Variety of plants can be grown through hydroponic system like tomatoes,

peppers, rhubarb, cucumbers, squash, snow peas, beans, spinach, lettuce, strawberries, chard and broccoli are some of the examples.

The production of grains and pulses is limited by agro-climatic conditions while fruits and vegetables can be produced in the state itself. Drip irrigation system can support the watering needs of the plants when rain is scarce. Edible routes grows variety of green vegetables that can be grown in kitchen gardens such as lettuce, coriander, spinach, Swiss chard, baby corn, tomatoes, etc. Indigenous varieties of Seeds are sourced from agricultural universities, various horticulture societies.

E. cropping pattern

The pattern in which crop has been grown was really fascinating that, for high yield the crops they are placed near particular plants/trees that releases excess nitrogen. Intercropping is done where two or more kind of plants are grown together that gives more produce per unit area than sole cropping. To increase the germination probability they soak the seeds in a mixture of animal manure. Edible routes follows the principles of permaculture — a self-sufficient and sustainable agricultural system. Plants nutritional requirement is fulfilled by natural compost and fertilisers. Kitchen waste is the cheapest and best option to make compost, as recommended by the founder of the start-up.

Edible Routes have four part time volunteers who work for the welfare for the farm and get vegetables and fruits in return for their contribution. One volunteer is being paid, as the concerned person assists the manager full time in organising workshops and attending conferences. An active member of the edible routes, mentioned her family of three could be able to meet their vegetable needs with a kitchen garden of 100 sq. feet. Thus livelihood based on commercial farming may not be viable but it can surely become a side income for people who stay at home, such as house wives, retired people, etc. By growing vegetables in the area available on

roofs and balconies in every building, Delhi will be fed and it will also cater to neighbour cities. Edible roots adheres to traditional farming tools but Mr. Kapil feels the modern techniques should be adapted for farming activities in urban area to maximise yield and minimise ploughing time.

F. Problems and Constraints in Urban Farming

At present, Urban farming is being considered as a 'Traditional Exploitation' and 'Outcast' industry by rural farmers. (Dev, 2012) Often, immigrants who arrive with new agricultural technology may face isolation or even social ostracism as new arrivals and they either choose not to share their methods or do not communicate with other urban farmers. The production of those products then becomes socially assigned to that group thus blocking the way to let the 'Community' in (Smit, 2001). The key constraints that relates to the New Delhi City urban farmers are:

- One of the main challenges can be land access because of high land prices and potential prohibition on farming in some places. (The Urban farming guidebook, 2013)
- Dust, pesticides associated with farming activities. (The Urban farming guidebook, 2013)
- In edible routes, proper fencing system was not equipped. Thus urban farmers often face the risk of 'Theft' which leads in harvesting before the crop reaches its peak that in turn reduces market value. In edible routes a board has been installed in the field indicating the crop being poisoned to overcome theft.
- Post Production constraints by inadequate processing, storage, packaging, distribution, and marketing facilities. (Dev, 2012)
- Restrictions on farm structures such as greenhouses and storage sheds. Lack of insurance makes farming more risky in the terms of disasters whether natural or manmade. (Ramasamy, 2004)

If these constraints are removed, urban farming will become more competitive and efficient, and participation by new practitioners in additional

locations becomes possible. Edible routes organises workshops that prepares food and feeds the customers from the crops grown without harmful fertilisers to promote healthy living through growing organic vegetables in their houses. Hence the key to unblock these various constraints is to increase awareness of the importance of urban agriculture.

G. Urban Farming Initiatives Within India

Gardening has recreational value. It acts as a stress reliever and is a popular hobby around the world. The major challenges faced by urban farming in Delhi is extreme climatic conditions, the myth that related to farming in cities is not practicable and unfavourable solution. Also architectural structure of the buildings doesn't facilitate farming.

In India urban agriculture is being carried out in many cities including Mumbai, Delhi, Kolkata, Bengaluru and Chennai under government, private agencies or even individuals. An important factor that they utilise is the use of treated or untreated waste water for agriculture. Urban farmers are neglected by the city authorities and urban space planners. Though majority of the urban farmers are urban poor (Yamuna river bank farm workers), urban farming is practised among people from all income groups. Practising urban farming can become a side income. The Mumbai Port Trust is one of the organisations to develop an organic rooftop farm after a training program given by the International Institute of City Farming. The organic farm sits atop the Port Trust's central kitchen, an area of about 279 square meters. (Ramasamy, 2004)

Mumbai Citizens are transforming terraces, balconies and common areas into vegetable gardens. Organisations like City Farming, *Earthoholics*, Fresh & Local Urban Leaves are helping people to grow their own food. A waste dump in Mumbai's Ambedkar Nagar slum is converted into a community garden. In Chennai, roof top farming has become a huge success. The

Government of Tamilnadu introduced “Do-it-Yourself” kit under the Urban Horticulture Development Scheme in 2014 to enable city dwellers to grow vegetables on open terraces of individual houses and apartment buildings. Being first introduced in Chennai, now the kit is available in Madurai also. (Sahasranaman, 2016) Agricultural labourers of The Kolkata Municipal Corporation uses aquatic plants and sunlight to treat the waste water and also strips of land in the low lying area to compost the organic waste from the city. The treated water is used for Pisciculture in 3500 hectares and vegetables are grown in 350 acres with 26000 urban poor working in this venture. (Gupta, 2013) Self help groups in Kerala empowering thousands of women financially in the production of vegetables on rooftops, balconies, backyards increased from 8.25 lakh ton in 2011-12, to 13.55 lakh ton in 2014-15 and is expected to increase substantially in the next three years. (Kerala State Planning Board, 2015)

H. Urban Farming Contribution Towards Agenda 2030

Almost all the SDGs are appropriate to agriculture. The route of linkage is either direct (Goal 2 - End Hunger) or indirect like SDG 8 on promoting Decent Work and Economic Growth which can be achieved if agricultural growth is promoted as an engine of employment including marginal and small farmers, women headed farmers, etc. Alternately, the below goals has an effect on urban agricultural approaches;

TABLE I

SDG #	SDGs influence towards urban farming	
	Goal	Contribution that can make to Agenda 2030
1	No Poverty	With respect to urban food insecurity and urban poor, agriculture can contribute more in reducing poverty than any other sector.
4	Quality Education	Agricultural expansion enables farmers to access to the skills, tools, inputs, and knowledge they require.

5	Gender Equality	Women constitute an important part of urban farmers, since agriculture related processing and selling activities can often be more easily combined with their other tasks in the household. (Hovorka, Zeeuw and Njenga, 2009); (Peter Jacobs, 2008) They tend to have most of the responsibility for feeding the households, while men tend to seek other urban employment.
6	Clean Water and Sanitation	An assessment by Water Aid informs about 80% of India’s surface water is polluted. By 2030, the global demand for water will be doubled. Thus conventional farming approaches avoids ground water pollution.
7	Affordable and Clean Energy	By 2030, the demand for energy will be doubled. More crops are likely to be grown for use of biofuels allowing greater fuel security.
11	Sustainable Cities and Communities	Economic, social and environmental links between urban, peri-urban and rural agriculture strengthens national and regional development towards food settlement.
12	Responsible Consumption and Production	The will to re-design the city “with food in mind” linking urban food planning, space and buildings design is, firstly a possibility for owners to grow their own food and secondly to have their own green space enhancing life quality, wellbeing, healthy diet and awareness toward food consumption.
13	Climate Action	Best practices in farming must help mitigate climate change. Although innovative ways to produce crops through vertical farms, greenhouses, and hydroponics exists, these technologies can be far more energy intensive than traditional approaches which cutbacks the greenhouse gas reduction initiatives. If properly engaged, urban farming could lead to the goal of reducing human impacts on the climate and building food systems.
15	Life on Land	Improving the quality of farmland helps to meet the demand for food and curtail the change of natural habitats and forests for additional cultivation. Urban farming reduces land degradation and biodiversity loss.

In addition to the above sustainable development goals that relates to urban farming, final Goal 17 (Partnerships for the Goals) strengthens the means of implementation and restores the global partnership for sustainable development in urban farming. Thus it is necessary to include the policies and regulations that enhances trade, multi-stakeholder partnerships to share knowledge, expertise, technology and financial resources particularly, in developing countries.

I. EXISTING GOVERNMENT POLICIES and REGULATIONS in DIFFERENT COUNTRIES

In 1999, St. Petersburg, Russia, the urban farmers produced more than that being produced in rural farms in the Leningrad region. (Nowak, 2004) Today there are several forms of urban agriculture flourishing, partly due to the government policies towards urban agriculture. One clause in the law states that that authority should help gardening associations with water supply and drainage, road construction and repair. (Nowak, 2004)

In Switzerland and parts of Germany, it is federal law that developers must either improve the biodiversity of existing land, or transfer the green space that is displaced to rooftop or other surface of the building. Old buildings are required to transfer one-fourth of displaced green area to their roofs. (Nowak, 2004) In 1989, Stuttgart Germany passed law that made compulsory to install green roofs over flat roofed industrial buildings. Moreover, incentives for green roof construction have been offered to more than 80 cities in Germany. (Leshner, 2012)

In British Columbia, Canada, a developer would receive tax relief if they allow a temporary use of personal parking space or unused lots for food production. This would encourage developers to consider temporarily allowing urban farms on their lands and thus sharing the produce. (Leshner, 2012)

Curitiba, the most liveable city in Brazil, with two hundred and eighty hectares of land for urban agriculture, benefited about seven thousand people in year 2005. (Smit, 2001); (Leshner, 2012) The master plan initiated in 1965 proposed the role of urban planning for public welfare that is inclusive of all economic strata. The role of government was crucial to facilitate urban farming at large scale. (Poulsen, 2014) Hence the municipal government took the following steps to propagate urban farming:

- Using municipal mechanisms for identifying public land for urban farming
- Providing assistance with inputs, seeds, fertilisers
- Providing basic training on soil mixture preparation and sowing procedures
- Providing environmental education without charges
- Monitoring the project for one year.

III. CONCLUSION

To implement urban farming on bigger scale community model is a possible solution - A system in which community members maintain the farm by working together and distribute the produce among them. This way the labour cost is compensated which is a major cost involved in farming. Community model increases the sense of community ownership and stewardship. For proper implementation of urban farming and food security programmes, it is important to have strong commitment of the government, support and participation of the citizens.

For some urban farmers, particularly where the food produced is commercialised, financial costs and profit maximisation are very relevant. For others who use urban farming as a form of subsistence other economic issues are important. For this reason selecting the appropriate techniques according to the socio-economic context is a priority. In case of edible routes it encourages by giving food/crops for work instead

of money. In order to produce food, a natural ecosystem has been transformed to agro ecosystems. This study recommends Cost-Benefit Analysis (CBA), sometimes called Benefit-Cost Analysis (BCA), is an economic decision-making approach where the ratio of net value of crop produce (minus cost of inputs) to cost of input, depicts the total financial return for each rupee invested in this production system (IGNOU, 2007) forms an important tool to assess economics of urban farming.

Crops convert solar energy into particular forms of biomass such as food, fibre, fuel or other human commodities. At present, conventional agriculture is more dependent upon external inputs than it was in the past. Many successful projects of urban farming all over India and beyond that has been discussed in this paper have helped breaking the stereotype. They have created awareness of its importance, benefits and potential to bring sustainable food system in cities through the approaches discussed in this paper.

Future research on urban farming and food metabolism should systematically identify the conditions and mechanisms (political, economic, social, cultural and ecological) that contribute to urban food security or insecurity. Such research

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will provide the basis for sound policy interventions which can make urban food systems more sustainable (in terms of quality of life and food security) and more efficient (in terms of resource use). As more Indians are towards experiencing well nourishment, particularly with cancer and other chronic illness being connected to the exorbitant utilisation of pesticides in farming, this paper will serve as a link for families hoping to cultivate together. Bringing in SDGs connection with urban farming in this study has helped in identifying the targets to address immediate needs as well as to enhance the resilience of population and ecosystems.

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