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Full Length Research Paper

The potential of environmental benefits of urban agriculture and their future

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Abstract

The population of cities in India continues to expand exponentially. It is predicted that by 2050, 55% of Indians will be living in urban areas. Traditional Agricultural Industry is challenged to keep pace with this as it is estimated that agricultural land capacity can increase by 2% only. The concept of Urban Farming has gained the serious attention of Planners and Academic communities in India. The combined issues of Population explosion, rapid urbanization and climate change are posing great threat to the Food Supply. Urban Farming is seen to have potential for cities to have at least some measure of Food Security. Urban farming is a process of using innovative scientific farming techniques to produce high yield and high quality of fresh organic food in very limited urban areas like terraces and balconies, all year – round. It is seen to have many advantages including non- dependence on vagaries of Climate, use of recycled water from Sewage and treated Wet waste as compost, proximity of producers to consumers, reduction of carbon footprints etc. The Concept of Urban Vertical Farm has been around since the 80's but the Urban Farming Industry is not growing so fast. The main challenges seem to be Economic viability and Sustainability There is still a lack of any comprehensive knowledge and know- how in the public realm regarding practical aspects of Urban Farming. The Economic costs and viability for large scale urban Farming seems prohibitive. Thus, so far, the urban farming industry has not grown much.

Keywords: Environmental benefits, urban agriculture, food supply, urban farming

Introduction

An industry that produces, processes, and markets food, fuel, and other outputs, largely in response to the daily demand of consumers within a town, city, or metropolis, many types of privately and publicly held land and water bodies were found throughout intra-urban and peri- urban areas. Typically urban agriculture applies intensive production methods, frequently using and reusing natural resources and urban wastes, to yield a diverse array of land-, water-, and air- based fauna and flora contributing to food security, health, ◦livelihood, and environment of the individual, household, and community.

Today, some cities have much vacant land due to urban sprawl and home foreclosures. This land could be used to address food insecurity. One study of Cleveland shows that the city could actually meet up to 100% of its fresh produce need. This would prevent up to $115 million in annual economic leakage. Using the rooftop space of New York City would also be able to provide roughly twice the amount of space necessary to supply New York City with its green vegetable yields. Space could be even better optimized through the usage of hydroponic or indoor factory production of food. Growing gardens within cities would also cut down on the amount of food waste. The US has an approximated population of 324,874, 430 people. This figure represents about 4.45% of the global population. The American inhabitants live a highly developed life. In fact, close to 85 percent of them live in the municipal regions. Hara, Murakami, Tsuchiya, Palijon, and Yokohama, conducted research in one of the Philippines' urban regions, namely Metro Manila, where they investigated the level of vegetable farming in the region. (Yuji Hara, *et.al* 2013) [1].

The rate of urbanization in the Philippines and other regions has also been on the rise. This situation has raised questions among authorities concerning how to sustain the huge urban population with respect to transportation, accommodation, and food supply. Currently, the world population is approximated at 7.1billion. The number is anticipated to double in the near future, thus posing a threat to the food supply. Urban agriculture provides a platform to circumvent food insecurity. According to recent statistical findings as Islam, Rabiul, Siwar, and Chamhuri reveal, "UA is a means of stabilizing household food security and prevents massive malnutrition. (Rabiul Islam and Chamhuri Siwar *et al.* 2012) [2].

The process of initiating urban agriculture appears to be technical in the town due to the bureaucratic pressure that requires participants to be skilled. Furthermore, as Ricci, Mattogno, Monardo, Palazzo, and Valentino observe, the witnessed stiff competition on agricultural products in San Diego has led to an increased interest in high-quality production (Manuela Ricci *et.al* 2014) [5].

To overcome the challenges that are associated with urban agriculture in the city, local authorities have launched several initiatives to enhance urban farming. For example, the City Farmers Nursery was introduced in the 1970s to educate farmers on urban farming, especially poultry farming. The city also has the San Diego Foodscaping as an organization that is committed to guiding the residents on organic farming techniques. Furthermore, it also has Seeds@City Urban Firm, which seeks to promote farming among urban youths. These programs have helped the city to make impressive progress towards investing in urban agriculture. They have helped the town to protect its endangered plants and animals while assuring the urban dwellers of their food security. Moreover, they provide an easy platform for youths to get employment, especially in underserved communities (Manuela Ricci *et al.* 2014) [5].

New York City is one of the most populated cities in North America. It is highly developed with reference to its impressive real-estate project. While one would not expect urban agriculture in New York, many projects have been established here to promote farming within and around the city. In fact, the city is a leader when it comes to urban farming in the US. It has over 700 farms with an average minimum size of 2500feet. Urban farming in the town is not only meant for the residents to get a variety of fresh crops but also to help in accomplishing community goals such as education, conservation of the environment, and storage of rainwater, among other goals (Lam *et.al* 2007) [3].

The unity of the non-governmental organization and the city authorities has helped to integrate urban agriculture as part of Philadelphia's urban lifestyle system. The city is still committed to improving the state of agriculture, as evidenced by the various legislative amendments and the ratification of new policies to favor urban agriculture. According to Ricci et al., UAUC is an effort that is meant to localize urban agriculture in the area since it matches the city's vision of "promoting land-use policies and programs recognizing the value of small farms preserving regional lands (Manuela Ricci *et al.* 2014) [5].

The situation will encourage the growth of a localized food economy. In a span of five years, beginning from 2002 to 2007, farms in the US increased by 4%. Approximately
2.2million US citizens have declared farming the best practice. Most of the farms are small and owned by women. Thus, they serve the local markets. Urban agriculture also received a strong boost from the inspiration by the US First Lady Michelle Obama, who initiated farming projects in the White House. Her inspiration has seen a 40% upsurge in the number of gardens in various towns in the US. Urban agriculture is increasingly becoming a popular concept in the US with reference to the way it has captured the awareness of many scholars who want to investigate the issue of food integrity and people's health in the region as Wortman and Lovell confirm. (Sort Wortman and Sarah Lovell *et.al* 2013) [4]. For instance, industrial farms prefer to use machinery to produce their products in bulk because of the large market that they to satisfy. On the other hand, in the case of urban agriculture, farmers always pay more attention to the quality and safety of products they release into their communities. A similar case can be witnessed in San Diego City, where consumers, farmers, and students work to promote the cultivation of local foods. Their claim concurs with Beckford and Campbell's position that consuming regionally produced foods helps in establishing a healthy community that has a stable local economy (Clinton Beckford and Donovan Campbell *et.al* 2013) [6].

Urban Farming

Urban farming includes a wide range of projects and activities relating to food production. And with the recent revival of farming in and around towns, through growing food themselves and attending farmer's markets, people have been reconnecting to agriculture. This rapidly growing trend has the potential to feed communities and generate economic opportunities. Urban agriculture is popular for a variety of reasons including sustainability, affordability, health, and convenience. There are many types of urban agriculture today, including community and backyard gardens; planting on the rooftop and balcony; increasing in vacant lots, the list goes on in parks.

Urban agriculture, urban farming, or urban gardening is the practice of cultivating, processing, and distributing food in or around urban areas. Urban agriculture can also involve animal husbandry, aquaculture, agroforestry, urban beekeeping, and horticulture. These activities occur in peri- urban areas as well, and peri-urban agriculture may have different characteristics. Urban agriculture may represent varying rates of social and economic growth. It can be a social movement for sustainable societies, where organic farmers, "foodies," and "locavores" form social networks focused on a common ethic of nature and holism of society. Such networks will grow when formal institutional support is provided, becoming incorporated into local urban planning as a campaign for sustainable urban growth called "transition town." Food protection, education, and producing income for others are the main reasons for the profession. In any case, more direct access by urban agriculture to fresh vegetables, fruits, and meat products will improve food security and food health.

Types of Urban Agriculture

1. Backyard Gardens: This is cultivating food in the homeland. Its produce is mostly shared between friends, family, and neighbors as it typically leads to a harvest surplus. The food can be preserved and conserved as well. Backyard gardens benefit communities as neighbors can share each other's backyard and use different farming methods leading to better yields.

2. Street landscaping: That is the landscaping of streets for various purposes, such as community gardens, that the local residents prefer to use for. Not only do they make the streets look beautiful but they also purify the air and create a clean atmosphere. Because they are located primarily along the street, their added advantage is their ability to reduce urban runoff from stormwater**.**

3. Forest gardening: This relates to the tradition of growing gardens within an urban forest. Forest planting is accomplished

by the production of various crops, vegetables, and fruits in urban environments. Forests typically provide an atmosphere conducive to crop production, and for this purpose, they help preserve forests and can render deforestation a nonfactor in urban settings. Forest planting may also be part of afforestation activities, which enables trees to be planted as a step towards mitigating global warming in urban areas.

4. Greenhouses: This includes agricultural practice in greenhouses in residential, industrial, and public urban spaces. They need a considerable land area to be set up depending on the crops being planted. Greenhouses provide farmers with the opportunity to grow a crop throughout the year as they provide a regulated environment in which the crops can be exposed to the different conditions needed for production.

5. Rooftop gardens: Since urban areas have limited space, it doesn't mean that they can't practice agriculture. This is where space on the rooftop comes in because they can easily be used to grow vegetables, fruits, and herbs. The downside of rooftop gardens is that it can help to minimize urban heat island and enhance the air quality. Apart from these, gardens on the rooftop can be used to beautify leisure establishments.

6. Green walls: The green wall includes vegetation or food crops growing on a wall's external or internal area. It does not take up much room as the system used helps to supply sufficient water to the food and it uses soil present on the walls. This is a good way to reduce the runoff from stormwater**.**

7. Vertical farms: It theoretically entails planting upwards to reduce the footprint of agricultural property. Green walls may be used as a tool for vertical farms as they often use limited space and are performed on the vertical wall sides.

8. Container Gardens: Perhaps the most common way for urbanites to participate in gardening, container gardens are a perfect way to transform a small farm into some outdoor space or window room. Without much time or effort, urban farmers may grow many fresh vegetables and herbs for themselves simply by using containers as a place to plant food crops. There are no legal hoops to go through and there are readily available resources and information for help**.**

9. Patio Gardens: The patio garden, an extension of the container garden, is typically similar but on a much larger scale. Many apartments and condominiums have patios that look out over the neighborhood and have clear access to sunshine, most importantly. These can be transformed into small gardens that grow all kinds of produce. Many patio gardeners combine hanging pots and containers to create a three-dimensional urban farm on their deck.

10. Polyculture for Small Gardens: Anyone with very little room to grow food would possibly use polyculture as a way to increase crop yields and diversity. Simply put, polyculture is the combining of plants within a garden to provide several plants (and crops) at once. For example, growing lettuce at the foot of corn plants will provide both commodities in a small space. The same allows for the combination of climbing plants on a trellis with bush-type plants at the trellis' foot. This intensive approach provides high yields for small spaces, which requires a great deal of soil input to make it fertile enough for the plants.

Benefits of Urban Farming

Urban farming has a lot of advantages, not only for those involved but also for the local city.

a. Urban Farming Provides Food Security

Organic produce is not cheap in grocery stores. A large number of families can't even afford to purchase organic food. Food protection means giving people access to healthy and appropriate nutritious food for their families around the world. Urban farming offers families greater access to food security. This also provides people with a way to add to their profits without wasting too much on capitalization. Urban agriculture makes food sustainable so more people can access it.

b. Urban Farming Creates a Sense of Belongingness Living in the town is fast. Nearly everybody is on the move and there is barely any room for people to mingle and chat with neighbors. Urban farming is an important way to bring together urban dwellers — like community planting, urban farming brings a sense of belonging to most marginalized people within the city. It's a perfect way to put together like-minded people for a major cause.

c. Urban Farming Promotes Public Health

Cities have a growing population, and people suffering from obesity and other diet-related health problems are frequently found. Urban farming beings offer local populations affordable and safe food. This helps the community's people battle life-threatening conditions such as obesity, heart disease, and diabetes. Urban agriculture is also a healthy form of exercise and also promotes health and wellbeing.

d. Urban Farming Reduces Carbon Emissions

Localizing the source of a product helps to reduce the fossil fuel consumption required for processing, transporting, and selling food products. A typical meal has to fly from the farm to the table 4,200 miles away. Urban farming reduces the carbon footprint, as well as being affordable.

c. Urban Farming Introduces Innovative Techniques Urban farmers face the challenge of finding creative solutions

to address urban farming challenges such as land, capital, electricity, and waste, in a city space that lacks large open, fertile grounds conducive to agriculture. Innovative farming methods are implemented to help farmers grow products without losing quantity and quality.

e. Urban Farming Creates Jobs

Urban agriculture is a growing market. As it rises, it offers additional employment opportunities for city dwellers, particularly in areas where poverty and hunger are rife. The local economy is also boosted by small enterprises engaged in urban agriculture.

f. Urban Farming Creates Green Spaces

The first thing that comes to mind when thinking about urban areas is the tall buildings and massive infrastructures. Evidently, urban areas lack green spaces, which significantly influence an area's climate and environment. Urban farming enables green spaces to be built which adds a great esthetic appeal, provides calming and relaxing spaces, and reduces precipitation. Green spaces also mitigate the heat island effect by trapping carbon by photosynthesis.

Urban farming- opportunities and challenges

An analysis has been made of various sources, including opinions voiced by practicing Urban Farmers to summarise below the main Benefits and Challenges, opportunities and constraints posed for implementing Urban Agriculture in the context of Indian cities. It is formatted to align with the four pillars of Sustainability.

A. Urban Farming: Opportunities Urban Farming, although it appears to be simple, impacts a community in various ways. Provides Food security, environmental benefits, biodiversity, even the city form gets modified, city- dwellers get socially conscious and activated.

B. Environmental Integrity: Improved Waste management: The most important benefit of UA is its potential to utilize the organic wastes produced by the city. It contributes to natural resource conservations. It can turn waste from a problem in to a resource.

It reduces the public cost of transportation and management of waste. The funds saved can be better utilized for more constructive programs of urban amenities. As the private sectors gets involved in UA, citizens can create cleaner and better living environment especially in areas not receiving waste management service from Municipal corporations. Most cities today face acute problems in finding place for dumping waste resulting in air water & land pollution in cities & in bio regions. Examples of Ramsey site bio region Deepor Beel in Guwahati greatly disturbed due to dumping of garbage. Deonar in Mumbai is also a dumping ground, polluted the city when it caught fire. Waste water and solid waste systems are costly for city administration & yet they do not have capacity to service the entire city centre. Urban farming contributes to this process by

a) Producing crops for life stock consumption,
b) By composting wet waste and
c) Processing waste water for direct production and for irrigation.

C. Conservation of resources: UA assists the conservation of bio regions and their resources by reducing the pressure to convert deserts, mountain slopes and rain forests into cropland. Because Urban Agriculture methods are intensive, and yield from UA is estimated to be more than six times that of rural production.UA also uses very little water due to innovative irrigation systems (drip irrigation, aeroponic cultivation).

D. Replenishing of soil nutrients: Composting of organic wastes puts the nutrients back into the soil. There is no contamination of soil and water bodies. Significant ecological, economic and health benefits thus accrue. Enhancement of Bio Diversity: By greening the city, UA gives scope for Bio diversity of vegetation, birds, and return to their habitat. Many varieties of vegetables which have stopped being produced can be revived.UA beautifies the city, moderates the Microclimate and making it comfortable for living.

E. Disaster mitigation: This benefit of UA is perhaps least appreciated and least understood, for example, on steep slopes, flood plains, wet lands and other disaster prone areas, trees and orchards and marketable grasses such as vetiver can be planted They are excellent for reducing erosion and vulnerability to disasters.

Products that are grown by Urban Farmers

As stated, attempting to raise livestock such as cattle, pigs, and sheep within city limits is much harder for urban farmers, simply because of the legal restrictions. But most other items which can be produced by any traditional farm are on the table. Urban farmers produce vegetables, fruit, root crops, even grains and herbs and medicinal plants, or purely ornamental plant varieties.

The three of those products are more perishable than many other crop types. This gives urban farmers a major advantage in terms of freshness and efficiency compared to larger companies that might need to ship their commodity several days before they reach their destination. It can grow both microgreens and mushrooms indoors and take up very little space. Many urban farmers can grow these crops in converted shipping containers, or anything else that is basically one large room's equivalent size. Due to their short shelf life, leafy greens such as arugula and spinach get high prices that need growing outdoors or in greenhouses or wind tunnels. Nevertheless, market gardening techniques and practices can be used to grow large amounts of food in a tiny room.

Social Considerations

Urban Farming in its nascent stages in Indian cities is characterized by a high degree of professionalism with a structured knowledge transfer and cultivation practice. It clearly represents a projection surface, reflecting the community's environmentally conscious behavior.

Promotions of UA activities in residential areas make a significant contribution to sustaining and distributing knowledge within the community of practice. It is also attributed to other larger benefits, such as community building, management of green spaces and ecosystem service provision, including local climate, biodiversity and cultural services. Many organizations, for example in Mumbai, Bangaluru and Kerala are disseminating knowledge of results of their own research in Urban Farming suitable for their own area to the communities. This is bringing about a change in mind set and sensitivity towards the environment, Social wellbeing accrues.

Environmental Considerations

Closing The Loop, Sustainance of the environment and retaining Bio diversity is of utmost importance for a city to remain alive Piling up of garbage, soil erosion, destruction of vegetation, depletion of water bodies, pollution of resources are the killers of cities. Cities have a chance to turn the trends to make their city sustainable. Urban farming is a vital tool for sustainability. Closing the loop is the process where in all waste is converted into resources and utilized in a continuous closed loop.

Waste Management and Sewage management

The three R's of Waste Management, Reduce, Re-Use and Re cycle have to be put into practice at local levels. Compost from wet waste, and recycled water from Sewage can be comprehensively utilized by the city in Urban Farming in a CLOSED LOOP. Complete self- sufficiency in terms of Food production may not be possible and nor ideal, but maximizing the utilization of Waste is of vital importance for the Environment in the City. To foster the development and growth of urban agriculture, the city planners may have to consider implementing techniques that include zoning ordinances, comprehensive plans and, in some cases, state legislation Land-use Urban agriculture and food production systems if considered along with land use patterns, a comprehensive consideration of Urban Agriculture and protection of Environment can be made.

- Identification of land for urban agriculture;
- Major water bodies and marshy lands should not be filled up
- Waste lands can be used for tree plantation and urban farming;
- Agricultural land within metropolitan area is to be protected under the provisions of Town and Country Planning Acts;
- Underutilized areas on long banks of rivers or canals can be developed for urban-agro forestry including parks and garden at places;
- Planting fruit trees in the periphery of existing city parks, can generate employment and municipal income for maintaining of parks and other such areas;
- New townships and housing estates should incorporate city farming, horticulture, etc; from the planning stage itself;
- Derelict land, abandoned brick fields and other areas near industries should have an ecological restoration program making it part of the planning condition while granting permission
- Revitalization of canals will encourage aquaculture and fish production;

Urban farms transform their communities for the better across the United States

Urban farming thrives in vacant fields, in parks, on rooftops, and also in hospitals. As more people want to know where their food comes from, community leaders across the country are looking for creative ways for residents in their town to grow fresh produce. But urban agriculture does more than just provide access to locally grown food — it boosts economic growth, reduces carbon emissions, and addresses issues of environmental degradation, public health, poverty, and more by giving people more control over the food system. From quarter-acre farms run by elementary students to green roof gardens feeding thousands, here are a few urban farming ventures aimed at creating a better place for their society.

1. Detroit Dirt

The goal of Detroit Dirt is to build a zero-waste mentality through communities and move a low-carbon economy forward. It is a compost business that aims to complete the "life cycle" of food production through the recycling of waste into energy. Pashon Murray, the leader behind the Detroit composting revolution, is turning tens of thousands of tons of food waste away from landfills a year and into a closed-loop composting system Murray built entirely from the ground up.

Ohio City Farm is one of the largest contiguous urban farms in the United States and is located in Cleveland, Ohio. The farm, with over six acres, aims to provide the underserved residents of Cleveland with fresh, local, and healthy food, while also boosting the local food economy and teaching the community about healthy eating. It is also home to Refugee Response, an job training program that helps the newest immigrants in the city develop the skills required to thrive in their new communities by growing and selling fresh organically farmed products.

2. Acta Non-Verba

Located in Oakland, CA, Acta Non-Verba is an urban youth farm which is developed, cultivated, harvested, and sold by local elementary and middle-aged children. The quarter-acre nonprofit farm, developed and led predominantly by women of color from the surrounding neighborhood and a broader group, seeks to question patriarchal structures and climate with urban agriculture. ANV designs its monthly farm days, workshops, and after-school program to give young children the opportunity to explore nature in a secure, welcoming green space, studying, developing, and enjoying balanced, nature-based activities that will inspire them.

3. Boston Medical Center
When more hospitals strive to grow their own food for their patients and the community, one New England hospital has become a pioneer in the trend by putting a farm right on the rooftop of the hospital. Boston Medical Center is not only Boston's biggest rooftop farm, but it's also Massachusetts' first hospital-based rooftop farm. The 7,000 square foot farm grows more than 25 crops and aims to produce 15,000 pounds of food every season, along with a few beehives for honey production.

4. SAVOR…Chicago
Located on top of McCormick Place (North America's largest convention center), this rooftop farm is Midwest 's largest soil-based rooftop farm, according to the Chicago Botanic Garden, which maintains the farm through its Windy City Harvest program. SAVOR represents nearly 3 million customers a year at McCormick Place and has been recognized for its environmental leadership and creativity through Green Seal Certification and Environmental International APEX Certification.

Significance to the International Trade
Agricultural products like sugar, tea, rice, spices, tobacco, coffee, etc. constitute the major items of exports of countries that rely on agriculture. If there is a smooth development practice of agriculture, imports are reduced while export increases considerably. This helps to reduce countries' unfavorable balance of payments as well as saving foreign exchange. This amount may be well used to import other essential inputs, machinery, raw material, and other infrastructure that is helpful for the support of the country's economic development.

Urban Agriculture Important and its Role in Everyday Life
- In most parts of the world, agriculture is an important source of livelihood.
- This entails hard work, but it contributes to the nation's food safety and health.
- Agriculture was the primary source of the economy prior to the industrial revolution.
- With many trade options coming up, many are dependent on their income on agriculture.
- Agriculture is the most peaceful and environmentally friendly method.
- It is a very reliable source of life for humanity, as well as one of the honest sources of income. Many people from developing countries rely for their livelihood on agriculture.
- Some people still have agriculture as a side business in other businesses or jobs.
- Agriculture is not limited to cultivation and farming alone. It also includes dairy, poultry, forestry, beekeeping, and sericulture.

Conclusion
The present situation of urban agriculture in global & Indian context has been analysed and its role in shaping societies to lead a healthy lifestyle & to create a community, which can resist even in the period of food crisis has been understood. It has been found that, urban agriculture is not just about demarcating space for vegetable gardens, but about designing the whole system of how it is planted, pruned, watered and harvested. There can be innovative architectural solutions for each of these aspects to make the whole system a very sustainable solution. There can be better designs that give them the ability of doing farming without problems of drainage & maintenance made easy by the incorporation of systems that reuse, reduce & recycle the household waste. The architects have a very crucial role in help shaping a better lifestyle for the people, so that even though they don't understand it at the present, they can plug into it in the future by providing the facility initially.
Urban agriculture is a important technique in agriculture in urban aria in small places. The urban agriculture is help in full fill the requirement of food material, and decreases the food crises in India, because population are increase very rapidly and urbanization are increase in very fast so urban agriculture are very important. India is very rapidly growing country in world. Urban agriculture that crop grown in Roof Top, Hanging garden, Rode side plant. In Urban agriculture that involve several crops are grown that is Tomato, Potato and other vegetable are grown and other ornamental plant are grown, urban agriculture are currently trending in India. Urban agriculture is help in controlling the pollution and minimizes their pollution level. The urban agriculture is important alternative way to fulfil all needs and their help in release pressure of food crises and healthy life in all people. The present situation of urban agriculture in global and Indian context has been analysis and its role in shaping societies to lead a healthy lifestyle and to create a community, which can resist even in the period of food crisis, has been understood. It has been found that, Urban agriculture is not just about demarcating space for vegetable gardens, but about designing the whole system of how to it is planted, pruned, watered and harvested. There can be innovative architecture solutions for each of these aspects to make the whole system a very sustainable. There can be better designs that give them the ability of doing farming without problems of drainage and maintenance made easy by the incorporation of system that reuse, reduce the household waste, the architects have a very crucial role in help shaping a better lifestyle for the people, so that even though they don't understand it at the present, they can plug into it in the future by providing facility initially. In the coming future, when space become very limited in urban areas, urban agriculture could be incorporated along with the apartments or even in high risk building, solely for agriculture. By proper implementation and designing, urban agriculture can help to shape the life of the people as well as the community for their betterment, strengthening the relationship between the urban and rural areas, and in completely eradicating food crisis.

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