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New Generation Farming: Vertical Farming

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INTRODUCTION

Vertical farming is an innovative agricultural approach that involves cultivating crops in vertically stacked layers, utilizing controlled environments and techniques like aquaponics, hydroponics, and aeroponics, without the need for traditional soil. This method addresses the increasing demand for safe, pesticide-free, and nutrient-rich produce with minimal carbon and water usage (Pant et al., 2018). In ornamental horticulture, vertical gardens are referred to as green walls, living walls, bio walls, or vertical gardens (Jain and Janakiram, 2016). Given the world's growing population and limited available farmland, vertical farming has the potential to meet the rising global food demands.

Source: https://www.outlookindia.com/website/story/vertical-farming-with-less-water-over-smaller-areas/374555

History of vertical farming

The concept of vertical farming has historical roots dating back millennia. Notably, the Babylonian Hanging Gardens, approximately 2,500 years ago, represent one of the earliest examples of vertical farming. Centuries later, around a thousand years ago, the Aztecs practiced a form of hydroponics called chinampas, cultivating plants on rafts floating on rivers and lakes.

In the 1600s, French and Dutch farmers developed techniques to grow fruits against stone walls, creating microclimates that facilitated the growth of warmer-climate crops. However, the modern concept of vertical farming as we know it today was first pioneered by Dickson Despommier in 1999. A professor of Public and Environmental Health at Columbia University, he introduced the idea of vertical farming as a solution to various agricultural challenges (Policy paper 89, 2019).

Techniques of Vertical Farming

1. **Hydroponics:** It is a soil-less cultivation method that involves immersing plant roots in a nutrient-rich solution containing essential elements like magnesium, nitrogen, potassium, and calcium. This technique enhances root support, leading to higher crop yields while reducing water dependency.
2. **Aquaponics:** It is a sustainable agricultural system that mimics nature's closed-loop ecosystem by integrating plant cultivation with aquatic organism rearing. In this system, the waste produced by aquatic organisms becomes a nutrient source for plants, and in turn, the plants help purify the water for the aquatic organisms.
3. **Aeroponics:** It is a unique approach to plant cultivation that doesn't rely on solid or liquid mediums. Instead, plants are grown in an environment where their roots are exposed to a nutrient-rich mist or aerosol. This allows the plants to absorb the necessary nutrients directly from the air.

Suitable crops for vertical farming: Leafy greens, herbs, microgreens, tomatoes, strawberries, pepper, mushrooms etc.

Types of vertical farms

- **Vertical Farms in buildings:** Abandoned or new buildings are repurposed for vertical farming.
- **Shipping-Container Vertical Farms:** Old or recycled shipping containers are equipped with LED lighting, vertically stacked farms, climate controls and monitoring sensors.
- **Underground Vertical Farms:** Also known as 'Deep Farms', these types of vertical farms are built in underground tunnels, abandoned mine shafts or any subterranean environment.
- **Multi-layered vertical farms:** Multi-layered vertical farms can be built to maximize the use of limited space in urban areas. The farm can be built in a building or a greenhouse, and plants can be grown in stacked layers.
- **Hydroponic vertical farms:** Hydroponic farming can be used in vertical farms to grow plants without soil. This will save water, reduce the use of pesticides, and produce healthier crops.
- **Community vertical farms:** Community vertical farms can be built in residential areas to provide fresh produce to the local community.
- **Aquaponic vertical farms:** Aquaponic farming combines aquaculture (fish farming) and hydroponics. Fish waste provides nutrients for the plants, and the plants filter the water for the fish. This is a sustainable and efficient way of producing both fish and crops.

Advantages and Disadvantages of vertical farming

Sr. No.	Advantages	Disadvantages
1	Efficient land use	Huge initial investment
2	Year-round production	High Energy consumption
3	Water conservation	Need Technical expertise
4	Reduced pesticide use	Compatible Crop selection
5	Shorter supply chains	Crop Failure
6	Environmental Conservation	Limited crop diversity

Vertical farming in India

Vertical farming is an emerging trend in India, gaining traction as an eco-friendly solution to tackle challenges related to food security and urbanization. Although the market is still in its early stages, it is poised for substantial growth in the near future. The driving factors behind this growth include the ever-increasing demand for food due to population expansion, the necessity for sustainable agriculture, and the rising popularity of urban farming.

According to a report by Research And Markets, the Indian vertical farming market is projected to experience a remarkable Compound Annual Growth Rate (CAGR) of approximately 25% between 2021 and 2027. The hydroponics-based vertical farming systems dominate the market, mainly due to their efficiency and cost-effectiveness. Key players like Fresher Underwater Farms Private Limited, Future Farms LLP, Triton Food works Private Limited, and Altius Farms Private Limited are actively contributing to the market's progress through technological advancements and strategic partnerships.

With the potential for significant expansion, the Indian vertical farming market offers promising opportunities for the agriculture sector to embrace sustainable and innovative farming practices, contributing to a more secure and greener future.

Investment

In the context of India, the cost per acre for establishing a vertical farm can vary significantly based on multiple factors, such as the geographical location, the type of crops grown, the technology employed, and the required inputs. A study conducted by the National Institute of Agricultural Economics and Policy Research indicates that the initial investment for setting up a vertical farm in India can range from Rs. 50 lakhs to Rs. 1 crore per acre, depending on the chosen technology.

This cost encompasses expenses associated with constructing the vertical farm structure, installing lighting and irrigation systems, procuring nutrient solutions, and other necessary inputs to support crop growth. Additionally, the annual operational costs for maintaining and running a vertical farm may fall between Rs. 5 lakhs to Rs. 10 lakhs per acre. These operational expenses typically cover electricity, water usage, labor, and other inputs required for crop maintenance and harvesting.

It is crucial to recognize that these estimates are based on current market conditions and may vary depending on the unique circumstances of each individual vertical farm, making it essential for potential investors and stakeholders to conduct thorough research and consider specific factors influencing their farming venture.

CONCLUSION

Vertical farming is a rapidly evolving field with ongoing advancements in technology, automation, and sustainability. While it presents several advantages, there are also challenges to address, including high upfront costs, energy consumption, and scalability. Nonetheless, vertical farming holds promise as a sustainable and innovative approach to meet the growing demand for food in urbanized areas while minimizing environmental impact.

REFERENCES

Anonymous. (https://www.edengreen.com/blog-collection/what-is-vertical-farming)

Jain R. and Janakiram T. 2016. Vertical gardening: a new concept of modern era. In: Commercial Horticulture, © 2016, Editors, N.L. Patel, S.L. Chawla and T.R. Ahlawat, New India Publishing Agency, New Delhi, India.

Masterson, V. 2022. Vertical framing: Is this future of Agriculture. Climate Champions (https://climatechampions.unfccc.int/vertical-farming-is-this-the-future-of-agriculture/)

Pant T.; Agarwal A.; Bhoj A.S.; Joshi R.P.; Om Prakash and Dwivedi S. K. 2018. Vegetable cultivation under

hydroponics in Himalayas- challenges and opportunities. Defence Life Science J., 3 (2):111-115.

Park, W. 2023. How far vertical farming can go?. Future Planet. (https://www.bbc.com/future/article/20230106-what-if-all-our-food-was-grown-in-indoor-vertical-farms)

Policy paper 89. 2019. Vertical framing. National Academy of Agricultural Sciences, New Delhi

Report, 2022. Research and Market. Vertical Farming Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2022-2027 (www.researchandmarkets.com)

Swadesh, S. 2023. New Generation Farming: Vertical farming. (https://www.linkedin.com/pulse/new-generation-farming-vertical-swadesh saxena/?trackingId=GgyEL7%2BqTCOE55XW9qSn%2Fg%3D%3D)

Vertical Farm Daily, 2023(https://www.verticalfarmdaily.com/article/9518031/vertical-farming-in-india/)