

VERTICAL FARMING A HOPE FOR INDIA TO ERADICATE THE CRISIS OF FOOD SHORTAGE

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ABSTRACT

Vertical farming is the new hope for tackling many of the issues across the globe from food shortage to climate change , environmental degradation to promotion of biodiversity . With the growing population , it is estimated that by 2050 , we will have no food left to serve the population , if we don't increase our cultivation rate by 70 % in the upcoming years , Water crisis soil erosion and deforestation has made the land unfit for cultivation where vertical farming is a solution to this problem which produces plants with minimal water and no soil in a closed environment .Indoor farming is becoming relevant in many parts of urban sector and India since 2019 has been practicing vertical agriculture and it has ample amount of scope and also can overcome many issues from climate change to poverty and bring in fresh air and fresh organic food to the people , the problem of cold storage infrastructure and the problem of rotten food will also end , as indoor farming requires no particular climate condition , it is grown using LED light and artificial intelligence , with public awareness it can also help to eradicate poverty and double the production of food in India .

Keywords: Vertical farming , indoor farming , climate change , population , food shortage , biodiversity , fresh organic food

INTRODUCTION

The speed at which the population is growing , it is expected that by 2050 we will have more than 9 billion population on this planet . We will have to increase our food production by 70 % in the upcoming years to provide food to the growing population . Food security has already emerged as a threat to the globe world apart from that the biggest catastrophe the world is experiencing is climate change which has no let a single person unaffected . The world is experiencing climate change , resulting in rise in sea level , global warming , ice is melting , we are experiencing extreme hotter days and cold winters , seasonal rainfall , with rise in droughts and floods . Due to rapid deforestation across the world which has given rise to natural disasters

we are experiencing cyclone , floods and drought at a rapid range . Urbanization with unplanned growth has resulted in extreme use of natural resources like forest and water . The world is experiencing water crisis and it has emerged as a global issue , where maximum people will have no access to drinking water by 2030 . The UN adopted the sustainable development goals to tackle climate change and more towards a sustainable living by using of green energy , clean energy , eliminate poverty , hunger , decent work and many other to reduce the effect of greenhouse emission into the atmosphere the world is moving towards renewable source of energy and reducing its depends on coal and crude oil . The agriculture sector which is highly dependent on water for irrigation purpose especially crops like rice . Deforestation has resulted in soi erosion which has made the land uplift for cultivation following that we are facing water crisis , in many countries people don't have groundwater left in particular India which take out maximum amount of water for construction and irrigation purpose . In India 70 % of the groundwater is used for irrigation purpose and India grows most of the crops which require water . Countries across the world is facing water shortage for agriculture which is indirect affecting food shortage , we see many countries practicing more Horticulture which requires less water and soil used compared to agriculture crops , However that is not enough to resolve the problem , in particular in this COVID-19 period the farmers have faced huge problem when it comes to agriculture with 200 natural disaster taking place , the food industry has been badly effected , in order to tackle climate change and bring in food security . Urban and indoor farming was introduced in 2016 , which has increased by 2018 .Urban farming has been practiced across the world. Urban or indoor or vertical farming . Indoor farming can help to reduce climate change effect, maintain temperature , this is being practiced in the urban sector of all countries and even individual families have started indoor farming .

RESEARCH METHODOLOGY

For the purpose of this exploration , I have used a amalgamation of two of the archetypical social sciences research tools application –as they are authentic and brilliant method to assemble statistics from multiple appellant in an methodical and convenient way . Question were asked to the common youth , public policy Analyst , urban people ,farmers , interviews – consisting of several interrogation which were dispersed among representative of each contender group .

OBJECTIVE OF THE RESEARCH PAPER

The main areas of exploration in this paper incorporates

- 1.What is vertical/indoor farming , its benefit .
- 2.Vertical farming in India : a study .
- 3.Future of vertical farming in India and the world .

LITERATURE REVIEW

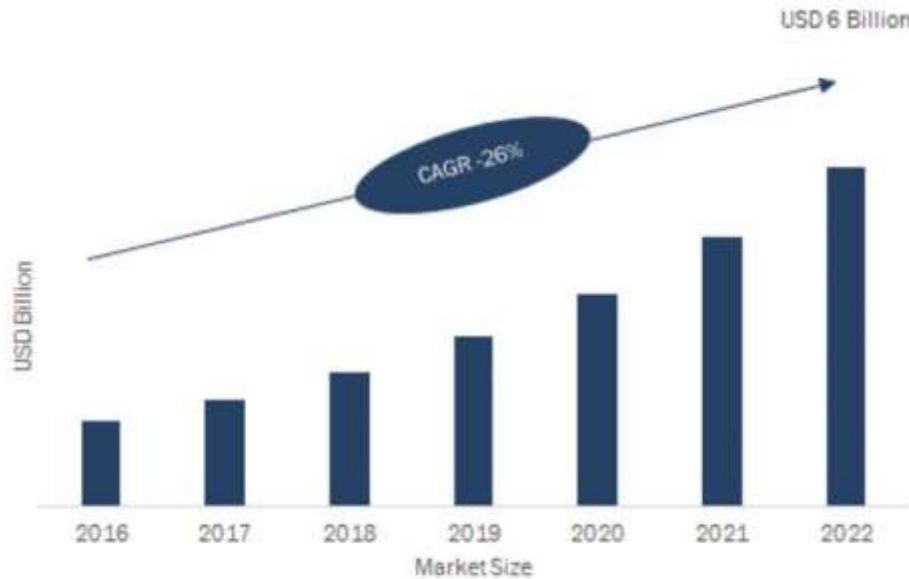
Indoor farming or vertical farming has many benefits compared to farming methods , as you don't require water , pesticides , fertilizers or soil for growing crops . The biggest benefit of vertical farming is that you don't need to dependent on climate condition , crops can be grown

throughout the year, It is grown in a protected and well monitored manner and bring assurance for farmers. It remains unaffected by the changing climate conditions , where as regular farming has to depend on nature and climate for growing crop , seasonal crops could be only grown , moreover you don't read fertile land or arable land for growing crops . It reduces water usage , as the vertical farming is done using Hydroponic process , only 10 % of the water is used and as a result the crop has all the required nutrients and the water remains clean which can be reused and recycle which reduces the waste and the cost . Indoor farming is also environmental friendly , as it minimize the use of fossil fuel as no fertilizers and cultivation is required for their growth , it helps to maintain biodiversity and also keep the wildlife alive and free from disturbance .No chemical or pesticide is used in vertical farming which makes the healthier , free from fungus , safer , no crop failure or damage . Above all it reduces transportation cost , as growing food closer to your location reduces the cost travelling and the long delivery from rural to urban regions , in this travelling at times the crops even get rotten and the transport also cause emission of carbon dioxide into the atmosphere . Moreover you will get access to fresh and healthy food which will provide your health more profit . It advances to Highly energy efficient as vertical farming require LED lighting which prerequisite ample amount of power to reach an optimal growth , where vertical farms can be used as a means to generate power . The farming is also safe for staffs and it requires less labour cost as the vertical farming is completely indoor with very less manual work required . People have grown tomatoes apple through indoor farming with 94% less water and no soil . Indoor farming in many areas have required the food security issue especially for urban poor people . Developing countries are adopting indoor farming as they are more affected by climate change , there is lack of food available to serve its people . Indoor farming can also increase the income and act as a job for many families which will also help to maintain the biodiversity , for a country like Bangladesh which is prone to flood , indoor farming can help to provide them with food security and for a country like India where the population is second largest . Indoor farming may be the future of farming with rapid climate change taking place .

FINDINGS

Hydroponics is cultivating of plants where you don't require soil ,it has a long history ,hydroponics used for growing in ancient civilization high value products , it started in the city of Babylon in its famous hanging garden . The indoor farming technology market was set to 23.75 billion dollar in 2016 which is estimated to reach 40.25 billion dollar by 2022 ..If we take the example of square roots , indoor farms it produces the same amount of food as produced in two or three acres farm in a year. The yield is achieved growing plants at 90 degree with the use of artificial intelligences to ensure the atmosphere is ideal for each and every plant which also includes the temperature of both day and night . Indoor farming can help in keeping the planet warm but can also reduce climate change level by becoming more sustainable with less use of water and emission of green house gases. Normally agriculture sectors accounts to 10 % of the greenhouse gas .

Square roots pop up farms are build on shipping containers in cities and at times in the parking lot areas . AeroFarms in New Jersey grows greens along with baby arugula , baby watercress and water kale using 95 % less water . Each plant gets the amount required followed by the excess water recycled using a closed loop irrigation which thus results in zero waste , many farms have adopted nanobubble technology like Moleaer to connect irrigation systems to make the water chemical free . Moreover nanobubble is cost effective , free from chemicals and appropriate solution which cuts down the time period of cultivation and all growers to sow more crops .AeroFarms , Square Roots and Plenty practice indoor farming using LEDS lights .



Vertical farming has seen a rise specially in the COVID-19 pandemic with that world facing food shortage , Vertical farming is done using technology and techniques like hydroponics , aquaponic and aeroponics which do no require soil for growing crops .Harvesting robots, greenhouse roof washers and automatic seed planters have worked to increase vertical farming and minimize the operating cost . North America is the fastest growing market when it comes to vertical farming .

Global Vertical Farming Market
OPPORTUNITIES AND FORECASTS, 2019-2026

Global Vertical Farming Market is expected to reach **\$12.77 billion** by 2026.

Growing at a **CAGR of 24.6%** (2019-2026)



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Coming to India where water crisis the biggest solution, farmers are extremely poor deforestation happens at a rapid space, food is wastage in an ample amount in the urban India, Lack of cold storage infrastructure , soil erosion , soil salinity the basic problem in India , where to poor land reforms , the agriculture land is very small for all the three categories of farmers from marginal , small and big in just a condition . Vertical farming is a solution to most of the problems in India , which is badly affected by Climate change . Vertical farming was introduced in India in 2019 .There are many vertical farming companies in INDIA , AS Agri and AQUA LLP , they are a group of professional who are working on hi-Tech agriculture and aquaculture and vertical farming. Tumeric vertical farming is happening in India under polyhouse. Polyhouse farming reduce the use of water 80% . It aims to practice vertical farming on the multi-storeyed building in New Delhi , Mumbai , Chennai , Kolkata.

Small scale vertical farming can be seen in the states of Punjab , Noida and Wet Bengal . Many projects in India have been launched with focus on vertical farming like Bidhan Chandra Krishi Vishwavidhaaya in Naida which have found initial success in growing tomato and brinjal . In Punjab is producing potato tubers using indoor farming . We have start ups in India which are working on vertical farming like Ideafarm a design in tech company which is producing vertical farming and their products are organic . Urban Kisan has formed indoor farming which requires 95% less water and not even 1 % land for farming compared to outdoor farming .It has saved 216000 litres of water in India which is used for farming per month .It has launched high-tech , sustainable , automated indoor vertical farms with high efficiency , food production system and delivered fresh and organic produces to many households Vertical farming is growing in India , which has to face many challenges like there is lack of public awareness , the cost of managing vertical farming , financing of Vertical farming However vertical farming is not meant for growing all kinds of plants .



WAY FORWARD

Vertical farming has a huge scope in India, which can also act as a substitute for family income indoor farming if adopted in India it can help to reduce the climate change and the solve the problem of food security. We need to explain and organize workshops on vertical farming to the village and in every village. Explain them the use of technology, we need to create infrastructure in the rural region for adopting vertical farming along with in urban area every home should be encouraged to practice indoor and home farming, there can start that in their terrace even. A person in Bangalore has grown apples in his balcony, Vertical farming can be practiced on the building and in open areas in urban sector which can to eradicate the issue of pollution, promote biodiversity which also bring in fresh air along with fresh food. We can use plastic bottle to plant as a method of reuse. Foreign technology and method like nanobubble technology, closed loop irrigation can be started in India. Hydroponic can be made in the urban areas and hence plantation can start. Aquaponic should start in India in particularly in the rural region which will provide both crop and income increment Fish and a vegetable, this can be done in the cultivation of rice where fish food will used as an source of fertilizer. India should bring in professional and technology experts to train the local people and rural India on Vertical farming. All states should adopt to vertical farming, along with the central and state together should look at the funding of the indoor farming. The COVID-19 pandemic has encouraged the idea of indoor farming, in fact horticulture and permaculture has started in urban India, Vertical farming with less water utilization can save water and might cure India from crisis of water in future. India also produces ample amount of fruits and vegetables after China. Vertical farming might amplify the production and the issues of cold storage will also be resolved, as there will be directly delivery and crops can be grown throughout the year.

CONCLUSION

Food shortage has been seen a major problem in the world, with rapid increase in population, lack of natural resources and other problems like climate change, soil infertile has affected the agriculture sector which has brought in the idea of vertical/indoor farming which has been adopted in many parts of the world, where as in India it was introduced in 2019, it has much more benefits compared to the traditional method of farming which can save water, make the product more healthy and organic, and solve the problems of environment like climate change, air pollution, biodiversity and wildlife exhibit, for a country like India, Vertical farming has plenty of scope which can eradicate the problem of food shortage what is all requires is knowledge, professional training and public awareness on the scope and benefits of this in both rural and urban areas.

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